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DIGITAL EUROPE: PUSHING THE FRONTIER, CAPTURING THE BENEFITS

JUNE 2016

IN COLLABORATION WITH
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HIGHLIGHTS



The MGI Industry
Digitisation Index



Variations among countries
in Europe



Gains from Digital Single
Market and much more

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MGI is led by Jacques Bughin, James Manyika, and Jonathan Woetzel, and chaired by Eric Labaye—all four are McKinsey & Company senior partners. Michael Chui, Susan Lund, Anu Madgavkar, and Jaana Remes serve as MGI partners. Project teams are led by the MGI partners and a group of senior fellows, and include consultants from McKinsey offices around the world. These teams draw on McKinsey's global network of partners and industry and management experts. Input is provided by the MGI Council, who co-lead projects and provide guidance; members include Andres Cadena, Richard Dobbs, Katy George, Rajat Gupta, Eric Hazan, Acha Leke, Scott Nyquist, Gary Pinkus, Shirish Sankhe, Oliver Tonby, and Eckart Windhagen. In addition, leading economists, including Nobel laureates, act as research advisers.

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DIGITAL EUROPE: PUSHING THE FRONTIER, CAPTURING THE BENEFITS

JUNE 2016



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PREFACE

European consumers are heavily invested in digital technologies—83 percent of people have access to the internet in their homes, and 76 percent say they use the internet regularly. But the reality is that Europe has a long way to go to fully tap the potential of digitisation. The extent to which companies have used digital to redefine business processes and their labour forces is still relatively low. Digitisation also varies greatly among countries, sectors, and companies within the region. If more is done to adopt, diffuse, and use digital, tremendous economic value could be captured. Although there are active initiatives to deepen Europe's digitisation, including moves towards removing barriers to a single digital market, proposals for the European Cloud Initiative, and a range of e-government initiatives, a further push is clearly needed. Our aim is to provide policy makers and businesses with a detailed fact base that will help to make such a push effective.

This report was written in collaboration with Digital McKinsey, a global practice that designs and implements digital transformations. Composed of nearly 1,500 digital experts across sectors and functions, Digital McKinsey creates value by reinventing the core together with its clients. This report also builds on MGI's analysis of digitisation in the US economy, *Digital America: A tale of the haves and have-mores*, published in December 2015. That research was the first major attempt to measure the digitisation of the overall US economy at the sector level, and it introduced the McKinsey Global Institute (MGI) Industry Digitisation Index, which combines dozens of indicators to provide a comprehensive picture of where and how companies are building digital assets, expanding digital usage, and creating a more digital workforce.

In this report, we have further developed that index to map digitisation in Europe and to compare the digital frontier in European countries to that of the United States. And we have added a new lens—looking at countries' final consumption of digital services, contrasting those that are building domestic capabilities and those that continue to rely on digital imports. The latter are losing out on potential economic gains from building a domestic base of digital technologies. Today, it is no longer sufficient to be a consumer of digital. To maximise the gains of approaching the digital frontier, countries must also develop the technologies and associated human capital.

This latest research on Europe has been led by Jacques Bughin, an MGI senior partner based in Brussels; James Manyika, an MGI senior partner based in San Francisco; Eric Labaye, MGI chairman and McKinsey senior partner based in Paris; Eric Hazan, a McKinsey senior partner also based in Paris; Peter Dahlström, a McKinsey senior partner in London; and Sree Ramaswamy, an MGI senior fellow based in Washington, DC. Caroline Cochin de Billy, a McKinsey consultant based in London, led the project team, which comprised Jaroslaw Bronowicki, Thibaud Desfossés, Tomasz Hada, Edouard Maurel, and Tim McEvoy. Sincere thanks go to Timothy Beacom, Paul-Louis Caylar, Rick Cavolo, April Cheng, Bryce Hall, Akshay Shah, Vivien Singer, and Soyoko Umeno. We would also like to thank MGI senior editors Janet Bush and Lisa Renaud; Matt Cooke, MGI director of external communications; MGI visual graphics specialist Marisa Carder, and designers Richard Johnson and Margo Shimasaki; MGI editorial production manager Julie Philpot; and Deadra Henderson, MGI manager of personnel and administration.

This report builds on a considerable body of expertise within MGI and McKinsey. We particularly want to acknowledge Michael Chui, Susan Lund, and Jaana Remes of MGI; Somesh Khanna, a McKinsey senior partner based in New York and global leader for Digital McKinsey in financial services; Gary Pinkus, a McKinsey senior partner based in San Francisco and the managing partner for McKinsey in North America; and Hugo Sarrazin, a McKinsey senior partner based in Silicon Valley and the global leader of McKinsey Digital Labs. We would also like to thank all previous MGI teams that produced reports on Digital America, big data, the Internet of Things, online talent platforms, and the automation of work. Thanks also go to the dozens of authors, researchers, and editors who produced insightful articles for *McKinsey Quarterly* on all aspects of digital strategy. In particular, the work of Tanguy Catlin, Ewan Duncan, Tunde Olanrewaju, Jay Scanlan, Marc Singer, and Paul Willmott provided us with valuable insight.

Our research was also enriched by insights from groundbreaking work by thought leaders who include Daron Acemoglu, David Autor, Erik Brynjolfsson and Andrew McAfee, Robert J. Gordon, and Bart van Ark. Finally, we are grateful to Al McConnell of Data2impact.

This report contributes to MGI's mission to help business and policy leaders understand the forces transforming the global economy, identify strategic locations, and prepare for the next wave of growth. As with all MGI research, this work is independent and has not been commissioned or sponsored in any way by any business, government, or other institution. We welcome your comments on the research at MGI@mckinsey.com.

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CONTENTS

HIGHLIGHTS



11

The MGI Industry Digitisation Index



17

Variations within Europe



27

The new world of work

In brief

1. The digital revolution is transforming Europe Page 1
2. Europe's digitisation is uneven, and still a distance away from its full potential Page 7
3. Europe's digital transition is poised to have significant economic impact Page 25
4. Businesses, policy makers, and individuals can all help to accelerate digitisation Page 39

Bibliography Page 49

A complete technical appendix describing the methodology and data sources used in this research is available at www.mckinsey.com/mgi.

IN BRIEF

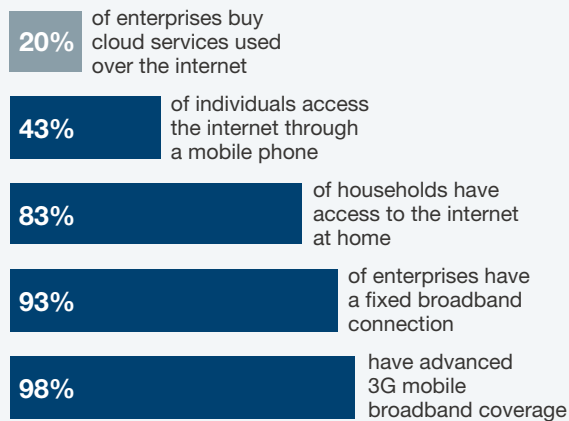
DIGITAL EUROPE: PUSHING THE FRONTIER, CAPTURING THE BENEFITS

Europe is in the midst of a digital transition driven by consumers, thriving digital hubs, and some world-beating digital firms. But digitisation is also about the extent to which firms and industries invest in, and use, digital. On this count, Europe's digitisation remains uneven whether we look at sectors, companies, or countries. Europe operates below its digital potential, and is dependent on the United States. Digital market initiatives will have large benefits—but more so with a concerted push to expand digital adoption within private and public-sector enterprises.

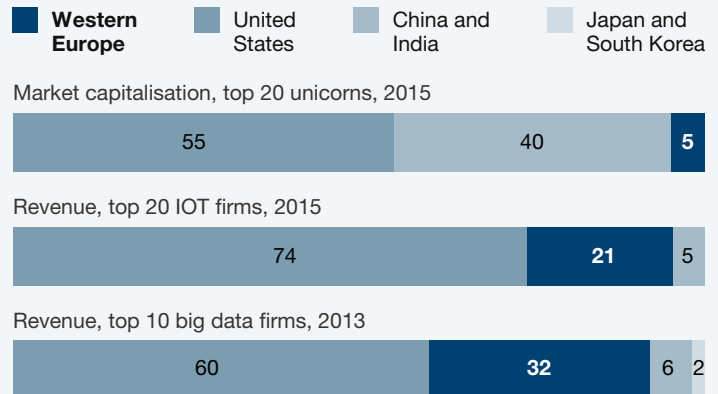
- MGI's Industry Digitisation Index is the first effort to capture how digitisation is spreading across Europe, compiling dozens of indicators to provide a picture of digital assets, uses, and workers. The index shows that Europe's economy is digitising unevenly, with large variations across sectors and firms. The information and communications technology (ICT) sector is at the digital frontier, measured by the digital intensity of assets, usage, and labour of that sector. Media and finance are close to the frontier, but large, traditional sectors lag far behind. Europe overall operates at only 12 percent of its digital potential.
- There is also enormous variation between Europe's countries. The United Kingdom operates at 17 percent of its digital potential, France at the EU average of 12 percent, and Germany at 10 percent. Countries like the United Kingdom and the Netherlands are net exporters of digital services to Europe, while Italy is a net importer. Country effects explain one-third of the variation in digital capability across Europe, indicating that countries can influence the extent of digitisation within their domestic economy. Sector effects—with the same sectors at the top of each country's digital heat map—explain the remaining two-thirds of variation in digital intensity across Europe.
- Europe underperforms on its digital potential relative to the United States. The European digital frontier, represented by the ICT sector and its digitisation of assets, uses, and labour, is only 60 percent as digitised as the US frontier. Some large sectors, such as professional services, wholesale trade, and real estate, are further behind the digital frontier in Europe than they are in the United States. Europe is a net importer of US digital services, running a digital trade deficit amounting to nearly 5.6 percent of total EU-US services trade.
- Europe's economy is already seeing the early impact of digitisation, with some correlation between productivity growth and digital intensity across sectors. We also find a mixed impact on the labour market, with rapid worker dislocation offset by new ways of working, matching, and acquiring skills. In the United States, we find sectors' digital intensity is correlated with their profit and wage growth. However, these effects are muted in Europe, in part due to the large digital capability gap relative to the digital frontier, both in Europe and the United States.
- Europe has key digital strengths that it can exploit for economic gains. The Digital Single Market could accelerate GDP growth, adding €375 billion to €415 billion each year, and providing a common platform to allow domestic firms to achieve scale. Even this is dwarfed by the GDP impact if laggard firms and sectors became more digitised. For instance, Europe could add €2.5 trillion to GDP in 2025 if laggard sectors were to double their digital intensity; this would boost GDP growth by 1 percent per year over the next decade.
- Business leaders, national and European policy makers, and individuals all have a role to play in accelerating Europe's digital transition. Companies must assess to what extent digital matters to them and how it might transform their business models. They must also adapt their organisations, digitise their operations, and promote open innovation along the way. Governments should be active on three fronts: unlocking investment and access to capital, opening up data flows, and addressing issues surrounding skills and the labour market. Ultimately, they will have to manage the social and economic transition brought by digitisation, including by mitigating its impact on job displacement. Finally, individuals need to develop their skills and embrace the flexibility and new opportunities that digitisation offers them.

The accelerating digitisation of Europe's economy

There are very few digital "have-nots" left in Europe

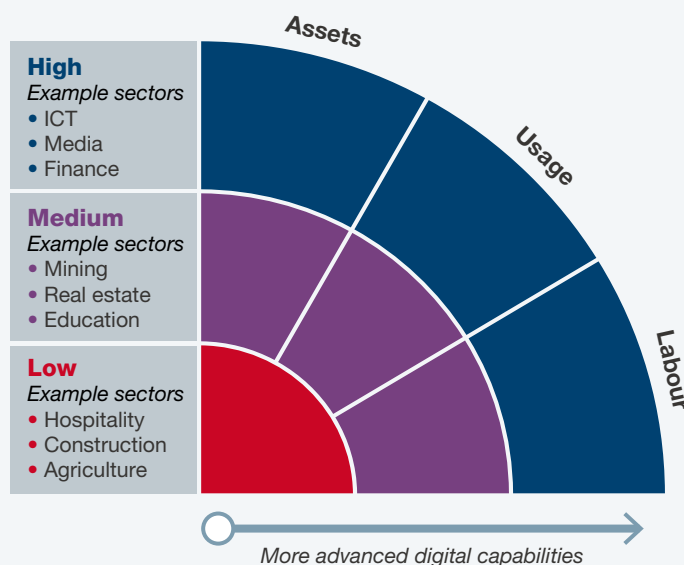


Europe lags in its ability to scale up unicorns, but new digital tech gives reason for optimism

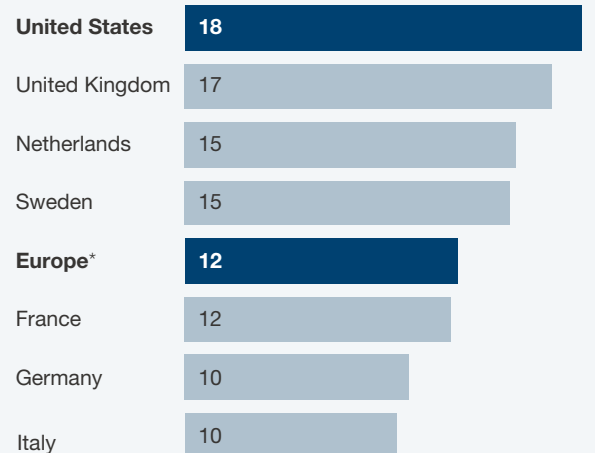


MGI's **Industry Digitisation Index** combines 20 indicators to measure digital assets, digital usage, and digital workers in each sector

MGI's European Industry Digitisation Index



Share of digitisation potential realised



* Weighted average of six countries that make up 60% of Europe's population and 72% of GDP

As the digital frontier expands, there is constant pressure to **adapt and evolve**

Companies

- Create new digital business models, and accelerate digital interactions with customers and suppliers
- Prioritise a handful of initiatives to exploit the biggest opportunities
- Be continuously vigilant to spot new technologies, startups, and disruptions
- Leverage new collaborative models such as data-sharing initiatives, crowdsourcing, and virtual collaboration
- Put digital tools in the hands of employees to ramp up productivity

Governments

- Promote the standardisation of telecom networks, regulation standards, and the logistics of e-commerce to create a single digital market
- Increase the flow of venture capital funding
- Promote free flow of data initiatives
- Make digital skills a core part of education curricula
- Develop targeted programmes to fill critical talent shortages such as data scientists

The Digital Single Market could add **€375 billion–415 billion per year to annual GDP** by 2022, and by 2025, digitisation of companies and industries could add **€2.5 trillion to European GDP**



1. THE DIGITAL REVOLUTION IS TRANSFORMING EUROPE

Who could have imagined 20 years ago how deeply our lives would change because of the spread of digital technologies? Governments are rapidly migrating online, cutting the cost of delivering services and simultaneously making previously time-consuming interactions much more convenient for citizens. Even soccer coaches are using big data to monitor their players' fitness and scout for new talent. Digital is disrupting the world of business in a multitude of ways, from creating new online competitors to helping companies that operate in the physical world gain scale at extraordinary speed. Individuals today can do everything online, from shopping—of course—to finding a job and even making investments. Young people conduct their social lives on smartphones, find their partners on the internet, and get married online. Digital technologies give citizens new ways of making their voices heard—voting online and even giving their views on budget priorities in the case of Parisians. Today, 98 percent of Europeans have advanced 3G mobile broadband coverage, and 61 percent look online for goods and services. And the pace of change is accelerating: digital platforms are proliferating and combining with one another. Network effects and low costs are fuelling waves of innovation that are becoming shorter and quicker.

96%
of Europe's
millennials have
used the internet in
the past 3 months

EUROPEANS ARE HEAVILY INVESTED IN THE DIGITAL AGE

There are many highlights in Europe's digitisation story thus far. Europeans are heavily invested in the digital age. More and more tasks and activities are now digitised. Across Europe, 39 percent of enterprises use social media, 76 percent of adults are regular internet users, and 96 percent of millennials have used the internet in the past three months (Exhibit 1).

Much of Europe has built impressive digital infrastructure. In fact, the United Kingdom leads the United States in terms of digital capital stock—resources that are key to developing new products and services, both tangible and intangible, for the digital economy.¹ Europe also has some thriving digital hubs, including Amsterdam, Berlin, Dublin, London, Paris, and Stockholm.² Highly successful European firms born during the age of digital technology—so-called digital natives—such as Spotify and Skype have expanded globally. Others have replicated successful digital business models found in other global markets. Many European firms are active in fast-growing areas, capturing 20 to 30 percent of revenue in big data and Internet of Things applications in the case of the largest digitised businesses.

Companies from all sectors are experimenting with digital, and they are transforming their businesses as a result. French insurer AXA is enthusiastically embracing digital trends, coming up with products such as AXA Drive Coach, an app designed for the Apple Watch that enables users to analyse and improve their driving behaviour, and its smart home hub, which uses the Internet of Things to give householders real-time protection against burglars, fire, floods, and gas leaks. The company has established a digital innovation sourcing unit in Silicon Valley to help maintain the pace of its digitisation.³

¹ Jacques Bughin and James Manyika, "Measuring the full impact of digital capital", *McKinsey Quarterly*, July 2013.

² *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016.

³ *AXA's digital initiatives: Digital insurance in action*, The Digital Insurer, accessed June 1, 2016.

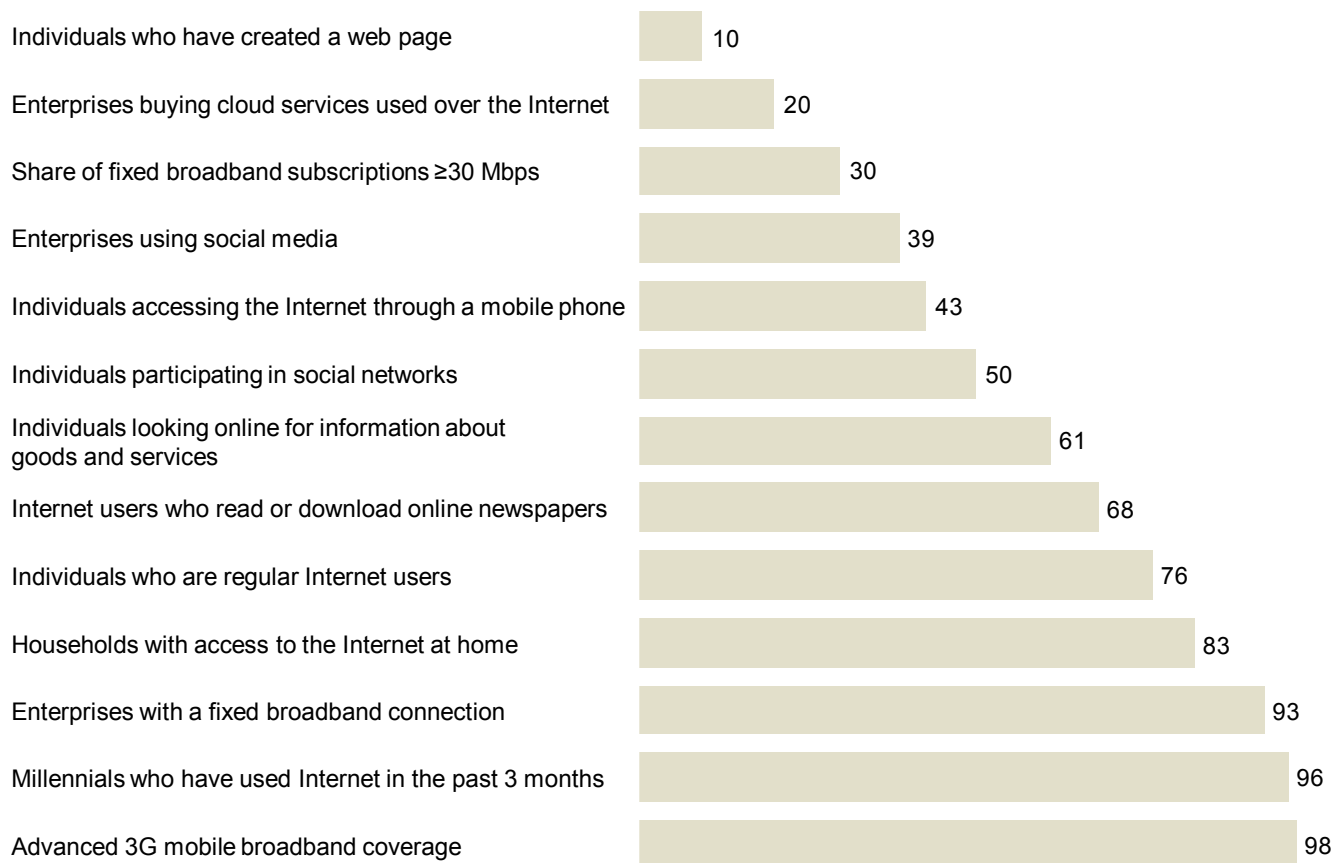
UK retailer John Lewis has piloted in-store 3D printing and radio frequency identification (RFID) technology to give customers a vivid digital snapshot of sofas in different fabrics on the company's Any Sofa Any Fabric platform.⁴ UK fashion house Burberry expects its heavy investment in digital to lead to e-commerce driving one-third of revenue growth over the next three years.⁵ Danish toy manufacturer LEGO increasingly crowdsources design through the Digital Designer 3D web-based tool.⁶

Exhibit 1

Europe has very few digital “have-nots”

EU-28 average

%



1 Megabits per second.

SOURCE: Digital Agenda Scoreboard Dataset, European Union; McKinsey Global Institute analysis

WAVES OF DIGITAL INNOVATION ARE ACCELERATING

Successive waves of digital innovation are becoming shorter and quicker (Exhibit 2). This acceleration is due to two distinct, related aspects of the process. The first of these is rapid technological innovation because of a proliferation of digital platforms and the ability to combine the latest technologies such as virtual reality, humanoid robots, cyber physical systems, and big data. Consider, for instance, the combination of technologies such as robotics, 3D printing, and the Internet of Things: together these create opportunities for new

⁴ Nicola Kemp, “John Lewis to merge real and virtual worlds in innovation drive”, *Campaign*, October 15, 2014.

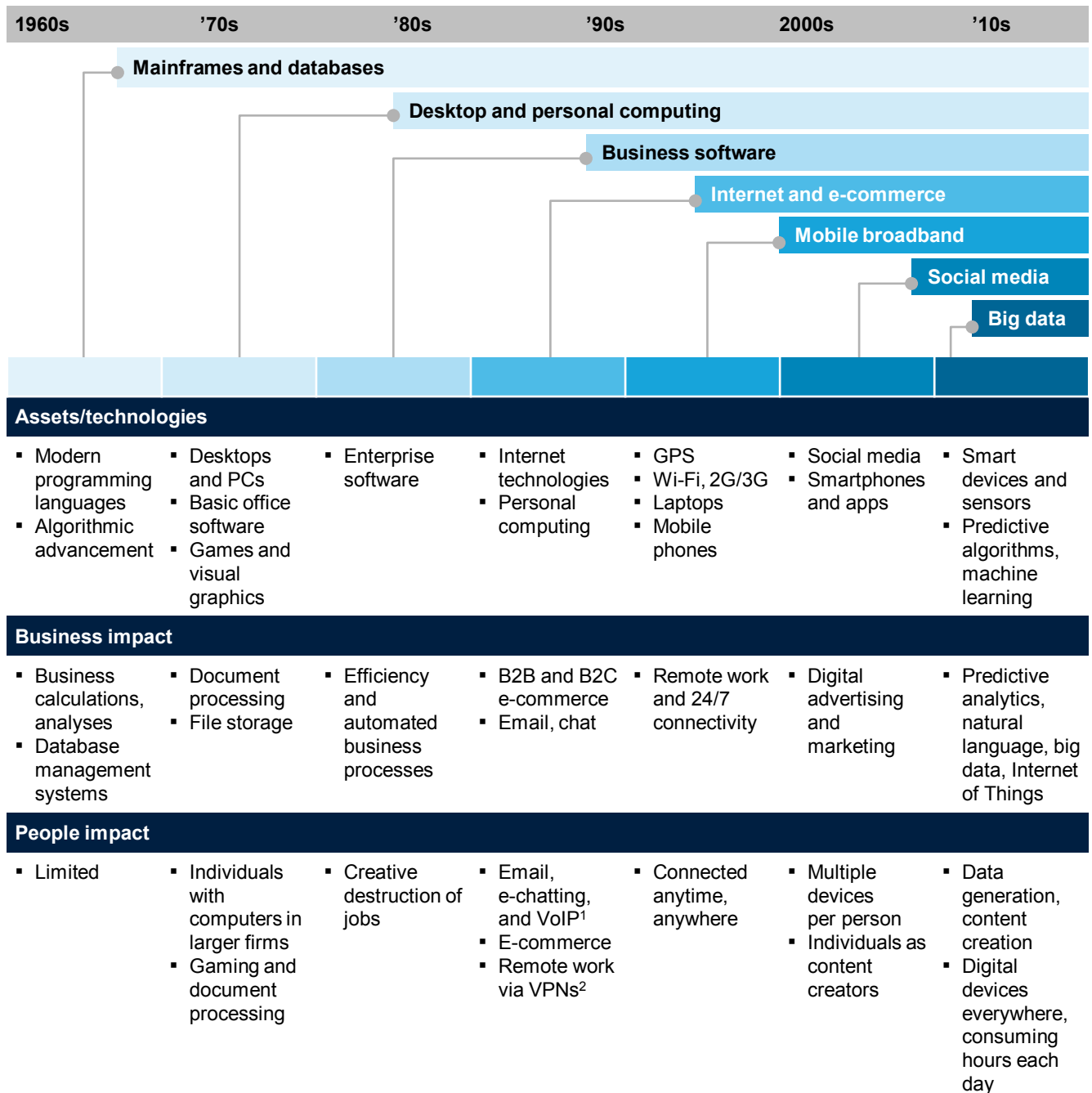
⁵ Stuart Lauchlan, *Burberry—moving from digital prowess to e-commerce leadership*, Diginomica, May 20, 2016.

⁶ The LEGO Group was one of the companies featured in the World Economic Forum’s Digital Transformation of Industries initiative.

processes such as Industry 4.0.⁷ Industry 4.0-related patents increased 12-fold between 2010 and 2015.⁸ By 2020, projections suggest that there will be 40 zettabytes of usable data globally, greater than the estimated number of grains of sand on all the beaches in the world.⁹

Exhibit 2

Successive waves of innovation have shaped the digital economy



¹ Voice over internet protocol.

² Virtual private networks.

SOURCE: McKinsey Global Institute analysis

⁷ For a discussion of the "fourth industrial revolution", see *The future of jobs: Employment, skills and workforce strategy for the fourth Industrial Revolution*, World Economic Forum, January 2016.

⁸ Zana Diaz-Williams, *Industrial technology trends: Industry 4.0 related patents have grown by 12x in 5 years*, IOT Analytics newsletter, March 1, 2016.

⁹ John Gantz and David Reinsel, *The digital universe in 2020: Big data, bigger digital shadows, and biggest growth in the Far East*, IDC country brief, December 2012.

The second reason is that adoption is speeding up because of network effects and low marginal costs. While the early phase of digitisation focused on computing power and its affordability, and adoption was relatively slow, the focus today is on connectivity, platforms, data, and software. All of these have inherent network effects and beneficial marginal cost economies associated with products and services being in digital rather than physical form, and can therefore spread at much greater speed. New digital technologies are scalable, cheaper, and better.

Advanced analytics are now becoming mainstream. In the United States, 400 staff members in the business intelligence operations unit at retailer Sears, for instance, were able to accomplish complex big-data-driven customer segmentation; previously, this exercise would have required PhD-level specialist analysts. Ocado, the UK online grocery retailer, processes more than 100 terabytes of data to drive its business decisions, from predicting what individual customers will buy next to planning the most efficient delivery routes. Thanks to cloud-based computing, computing power is getting cheaper and therefore much more widely available. Due to the Internet of Things—sensors embedded in goods—it is now possible for food producers, transport and logistics companies, and hospital and retail businesses, for example, to have an end-to-end view of business processes and supply chains at low cost. Photon, a tiny Wi-Fi development kit for prototyping and scaling Internet of Things sensors that is reprogrammable and connected to the cloud, is available today for only €17 (\$19). In accordance with Moore's Law, computing power has doubled roughly every 18 months to two years for decades. Now we are on the cusp of a new era of computing power in the form of quantum processors. D-Wave has developed a quantum computer that can perform specific tasks 100 million times faster than a conventional processor.¹⁰

¹⁰ Vasil S. Denchev et al., *What is the computational value of finite range tunneling?* Google, December 11, 2015.





2. EUROPE'S DIGITISATION IS UNEVEN, AND STILL A DISTANCE AWAY FROM ITS FULL POTENTIAL

For all the progress that Europe has made to digitise its economies, consumers, and societies, the adoption of digital technologies by businesses and industries has been uneven. Europe therefore remains some distance away from the digital frontier formed by the ICT sector in the vanguard and a number of other sectors with high digital intensity, including media and finance, just behind; large traditional sectors lag far behind.¹¹ Overall Europe operates at only 12 percent of its digital potential. There are also large differences among Europe's countries. The United Kingdom, for instance, operates at 17 percent of its digital potential, but Germany at only 10 percent. Countries like the Netherlands are net exporters of digital services to Europe, while Italy is a net importer. Overall, Europe's digital frontier is far behind the frontier in the United States.

In this chapter, we use MGI's Industry Digitisation Index to map Europe's digitisation at the sector level, and further discuss the digital landscape at the company and country levels.

MEASURING THE IMPACT OF DIGITISATION REQUIRES A PERSPECTIVE ON DIGITAL ADOPTION AND DEPLOYMENT ACROSS INDUSTRIES AND ECONOMIES

Most measures of digitisation in an economy tend to focus on market-oriented metrics, such as share of e-commerce, or output-oriented metrics, such as the value added by the ICT sector. While these measures are useful, they provide no indication of how the economy is assimilating digital capability across multiple sectors. For example, the ICT sector provides a view of how sectors have bought such technologies to support their digitisation, but purely measuring the ICT sector does not track the return on that investment: that is, the ability of companies to develop higher-value-added performance thanks to the diffusion of digital technologies in their workflow or in the way they conduct relationships with their customers and suppliers, for instance.

One measure relating to the ICT sector is useful, however, and that is the extent to which the sector is a net importer or exporter. A net exporter is a sector that contributes to the growth of the economy via the trade balance, and therefore should provide more employment and business opportunities. Unfortunately, measuring this aspect is not easy because data on the digital part of the ICT trade balance remain poor. However, we have attempted to provide an early estimate of this digital balance, focused on the thriving and disruptive part of the digital economy—examples include digital services commerce platforms Delivery Hero and Fartech; content services Shazam and Spotify; and software services Adyen and Klarna.

¹¹ McKinsey & Company has conducted a series of 11 sector case studies on digitisation, listed in the bibliography. These cover banking, construction, education, food, government, health care, industry, insurance, retail, telecoms, and utilities.

In this research we estimate the extent to which sectors within various European countries are absorbing and deploying digital capabilities and practices. To do so, we have created an Industry Digitisation Index that examines sectors across the economy through the lenses of digital assets, digital usage, and digital workers. The index gives a view across sectors of how enterprises are investing or spending on digital capabilities; how they deploy digital technologies to engage their customers, suppliers, and partners; and how they digitise their internal processes, create a digitally enabled workforce, and digitise work itself.¹²

The index uses 21 indicators to capture several ways in which companies are digitising (Exhibit 3). To measure digital assets, for instance, we consider business spending on computers, software, and telecom equipment, as well as stock of ICT assets. Usage metrics include an industry's use of digital payments, digital marketing, and social technologies, as well as the use of software to manage both back-office operations and customer relationships. On the workforce, we estimate the share of workers in each sector in digital-related occupations, and we determine digital spending and assets on a per-worker basis.¹³ The Industry Digitisation Index shows digital penetration across sectors and the gap between the digital frontier and the rest of the economy.

We also consider what the Industry Digitisation Index means in terms of an aggregate digitisation score (across sectors) that can be compared across European countries and vs. the United States. To do so, we weight the index per sector by the economic size of each sector, and we measure the distance of each sector from the digital frontier, as represented by the ICT sector of the United States. We choose this sector to represent the digital frontier for two reasons. First, previous MGI research has shown that the ICT sector is the most digitised in the United States, measured across the same three groups of metrics—digital assets, uses, and labour—that we apply to calculate the European Industry Digitisation Index.¹⁴ Second, looking at the trade balance of digital services, our analysis seeks to shed light on the perception that much of Europe's digital capability might be supplied by the United States.¹⁵ Sectors and firms that successfully deploy digital capabilities are able to realise efficiencies; however, to the extent that these capabilities are imported into Europe, there is a lost opportunity for additional economic gains in the form of domestic innovation, investment, and job creation.

¹² Roman Friedrich et al., *Measuring industry digitization: Leaders and laggards in the digital economy*, Strategy&, Booz & Company, December 13, 2011. For our index, we additionally include metrics related to digital assets and digital labour, two critical measures of how companies absorb digitisation and translate it into better performance. The assets component is important because it reveals investment activity in assets that are not yet being successfully deployed, thus providing a signpost for how digital is developing. The labour piece reveals the changing nature of work, which is where the digital frontier has been most advancing in the last decade. It shows how such investment is being deployed in the European workforce and the creation of new types of employment involving digital activity.

¹³ For a full description of our methodology, see the technical appendix of *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015. An additional appendix on the methodology used for this report on Europe is available at www.mckinsey.com/mgi.

¹⁴ Ibid.

¹⁵ The US Department of Commerce reports that the United States has a surplus with the rest of the world—and particularly with Europe—on deliverable digital services. See *Digital economy and cross-border trade: The value of digitally-deliverable services*, Economics & Statistics Administration, US Department of Commerce, January 27, 2014.

Exhibit 3

Metrics included in the MGI Industry Digitisation Index

		Metric	Description
Assets	Digital spending	Hardware spending	Share of total expenditures spent on ICT hardware (e.g., computers, servers)
		Software and IT services spending	Share of total expenditures spent on software and IT services (e.g., enterprise resource planning software)
		Telecommunications spending	Share of total expenditures spent on telecommunications (e.g., broadband access, mobile data services)
	Digital assets stock	Hardware assets	Share of total assets made up of ICT hardware (e.g., computers, servers)
		Software assets	Share of total assets made up of software (e.g., purchased software licenses)
Usage	Transactions	Enterprises selling online	Annual sales realised via any computer networks; computer networks include websites, EDI-type systems, and other means of electronic data transfer (excluding e-mails)
		Enterprises purchasing online	Percentage of companies doing at least 1% of their purchases via any computer networks; computer networks include websites, EDI-type systems, and other means of electronic data transfer (excluding e-mails)
	Interactions between firms, customers, and suppliers	Digital supply chain	Enterprises sending/receiving all type of information on the supply chain (e.g., inventory levels, production plans, forecasts, progress of delivery) via computer networks or via websites
		Social media use	Enterprises using two or more of the following social media: social networks, enterprise's blog or microblog, multimedia content sharing websites, wiki-based knowledge-sharing tools
		Companies with ICT very integrated into daily activities	Composite score based on McKinsey's 2015 survey on the digital capabilities of firms in Europe and the United States
		Companies with benefits from external customer-related tools	
		Companies with benefits from using social tools to work with partners	
		Companies where at least half of business is digital in nature	
	Processes	Enterprise Resource Planning use	Enterprises that have an ERP-enterprise resource planning software package, which they use to share information between different functional areas (e.g., accounting, planning, production, marketing)
		Customer Relationship Management use	Enterprises that use a CRM, i.e., any software application used for the analysis of information about clients for marketing purposes
Labour	Digital spending	Hardware spending on workers	ICT hardware (e.g., computers, servers) expenditures per full-time-equivalent employee (FTE)
		Software and IT services spending per worker	Software (e.g., enterprise software licenses) and IT services expenditures per FTE
		Telecommunications spending per worker	Telecommunications (e.g., broadband access, mobile data services) expenditures per FTE
	Digital capital deepening	Hardware assets per worker	ICT hardware assets (e.g., servers, computers) per FTE
		Software assets per worker	Software assets (e.g., workers software licenses) per FTE
	Digitisation of work	Share of jobs that are digital	Digital jobs (e.g., computer and information systems managers, web designers, social media community managers, database administrators, big data scientists) as a share of total jobs

SOURCE: McKinsey Global Institute analysis

THERE IS A SIGNIFICANT GAP ACROSS EUROPE IN DIGITAL INTENSITY BETWEEN LEADING AND LAGGARD SECTORS

MGI's Industry Digitisation Index for Europe indicates that there is a significant gap between digital leaders and laggards. Exhibit 4 shows the computation of the index by sector, aggregated across the 15 European countries for which we were able to collect all the necessary data. At or near the digital frontier are highly digitised sectors in terms of their digital assets and how they use them, and their digitisation of labour. These sectors include the ICT sector itself as well as a broader cluster of high-tech services such as media and finance. Professional services ranks consistently high across countries, reflecting high levels of new digital jobs and levels of investment per worker. The financial sectors of the Netherlands, Sweden, and the United Kingdom all perform strongly, a sign of the emerging financial technology, or fintech, sectors of Amsterdam, Stockholm, and London. The United Kingdom's media sector also stands out due to the strength of the digital media scene in the country. Over the past decade, the major driver of the digital frontier has been the digitisation of workforces: this has been the area of digitisation where successful digital firms have pulled away from the pack.

Digital laggards include asset-heavy sectors such as manufacturing and mining, quasi-public sectors such as health care and education, and highly localised and fragmented industries such as hospitality and construction. Many of these sectors lag behind the frontier in terms of digital usage and labour. The index also shows which aspects of usage and labour are especially weak; for instance, while these sectors have all tended to adopt digital payments to a degree, they lag far behind the frontier in the extent to which they have digitised their business processes and customer interactions. Sectors such as government and health care also have a long way to go in digitising their large workforces.

These laggards may focus on one or two aspects of digitisation, such as digital payments or software assets, but this has proved less effective than focusing on all dimensions represented in the index. In manufacturing and mining, for instance, companies are deploying digital tools to engage their customers, suppliers, and partners, but digital penetration in their physical assets (such as factories) remains relatively low. Sectors such as retail have also digitised their supply chains, but a long tail of small and medium-sized retailers is relatively lightly digitised. In some of these industries, new digital firms (and existing digital giants from other sectors) are creating disruptions that may play out rapidly in the future, but for now these laggard sectors, on average, have limited digital functionality.

The largest sectors in the European economy—in terms of assets, GDP, and employment—tend to be digital laggards, and the overall European economy has a long way to go in terms of digitisation. Measured against total investment stock, for instance, Europe's asset base is only 5 percent digitised. In terms of the usage of digital activities, European workplaces are only 9 percent digitised.

Exhibit 4

The MGI Industry Digitisation Index for Europe

2015 or latest available data

Relatively low digitisation  Relatively high digitisation

● Digital disruptors within relatively less-digitized sectors

Sector	Overall digitisation	Assets		Usage		Labour			Share of value added, 2013 ¹ %	Share of employment, 2015 ² %
		Digital spending	Digital asset stock	Digital transactions	Digital interactions	Digitised business processes	Digital spend per worker	Digital capital deepening		
ICT									4.5	2.7
Media					1				1.2	1.1
Finance and insurance					1				5.4	3.0
Professional services									6.3	6.0
Wholesale trade									6.5	5.3
Advanced manufacturing									4.4	4.2
Chemicals and pharmaceuticals		2							1.9	2.3
Utilities									2.3	1.0
Oil and gas					4				0.2	0.1
Basic goods manufacturing									8.1	7.8
Mining									0.8	0.4
Real estate	●								12.1	1.0
Transportation and warehousing	●								5.0	5.2
Retail trade	●				3				4.4	8.8
Personal and local services									6.3	7.8
Government	●							5	6.5	7.1
Education	●								5.3	7.7
Health care	●								7.4	11.1
Entertainment and recreation	●								1.3	1.7
Hospitality									3.0	4.7
Agriculture		6							1.7	4.2
Construction									5.3	6.8

Cluster descriptions

- 1 Knowledge-intensive sectors that are highly digitised across most dimensions
- 2 Capital-intensive sectors with the potential to further digitise their physical assets
- 3 Service sectors with long tail of small firms having room to digitise customer transactions
- 4 B2B sectors with the potential to digitise their customer interactions
- 5 Labour-intensive sectors with the potential to provide digital tools to their workforce
- 6 Highly localised and fragmented sectors that lag across most dimensions

1 Value added as proxy for GDP; 15 countries used as proxy by EU-28.

2 EU-28.

NOTE: The level of sector digitisation measures digital assets, usage, and labour by sector. It does not refer to the intensity of digital competitive threat in a sector.

SOURCE: EU Klems; Eurostat; OECD; McKinsey Global Institute analysis

12%

Share of its digital potential that Europe's economy has realised

GAINS FOR THOSE AT EUROPE'S DIGITAL FRONTIER ARE MUTED COMPARED WITH THOSE AT THE US FRONTIER

The digital frontier is continually evolving. It is a high-risk, high-reward environment. Beyond the ICT sector itself, digital usage is exploding as companies build new types of digital assets and connect them in ways that sometimes overturn existing business models. The Internet, mobile connectivity, social media, and smartphone apps have created a massive spike in consumer adoption. Today's businesses are stepping into the age of analytics and are using technology to analyse enormous troves of data for insights that can inform decisions.

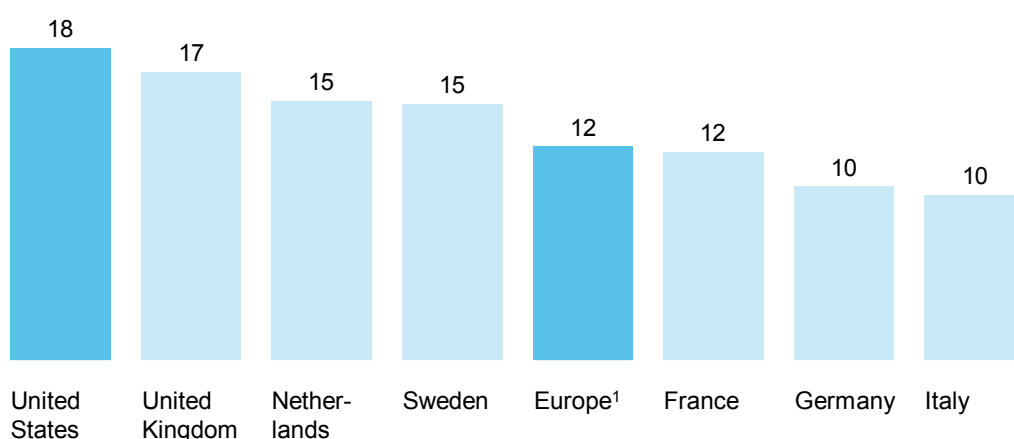
As a result of the digital gap between leading and laggard sectors, Europe's economy operates at only an estimated 12 percent of the digital potential exhibited by the digital frontier in the United States (Exhibit 5).¹⁶ If the European economy were to move towards digital maturity, there is tremendous economic upside. We see a similar situation in the United States, where the largest sectors are also laggards. The US economy is operating at only an estimated 18 percent of the potential shown by the digital frontier.

Exhibit 5

Europe and the United States are currently at only a fraction of the frontier and can still capture tremendous upside from digitisation

Captured potential by country

%



¹ Europe is the weighted average of the six countries shown here. These six countries make up 60% of the population, and 72% of GDP, in the EU-28 grouping.

SOURCE: McKinsey Global Institute analysis

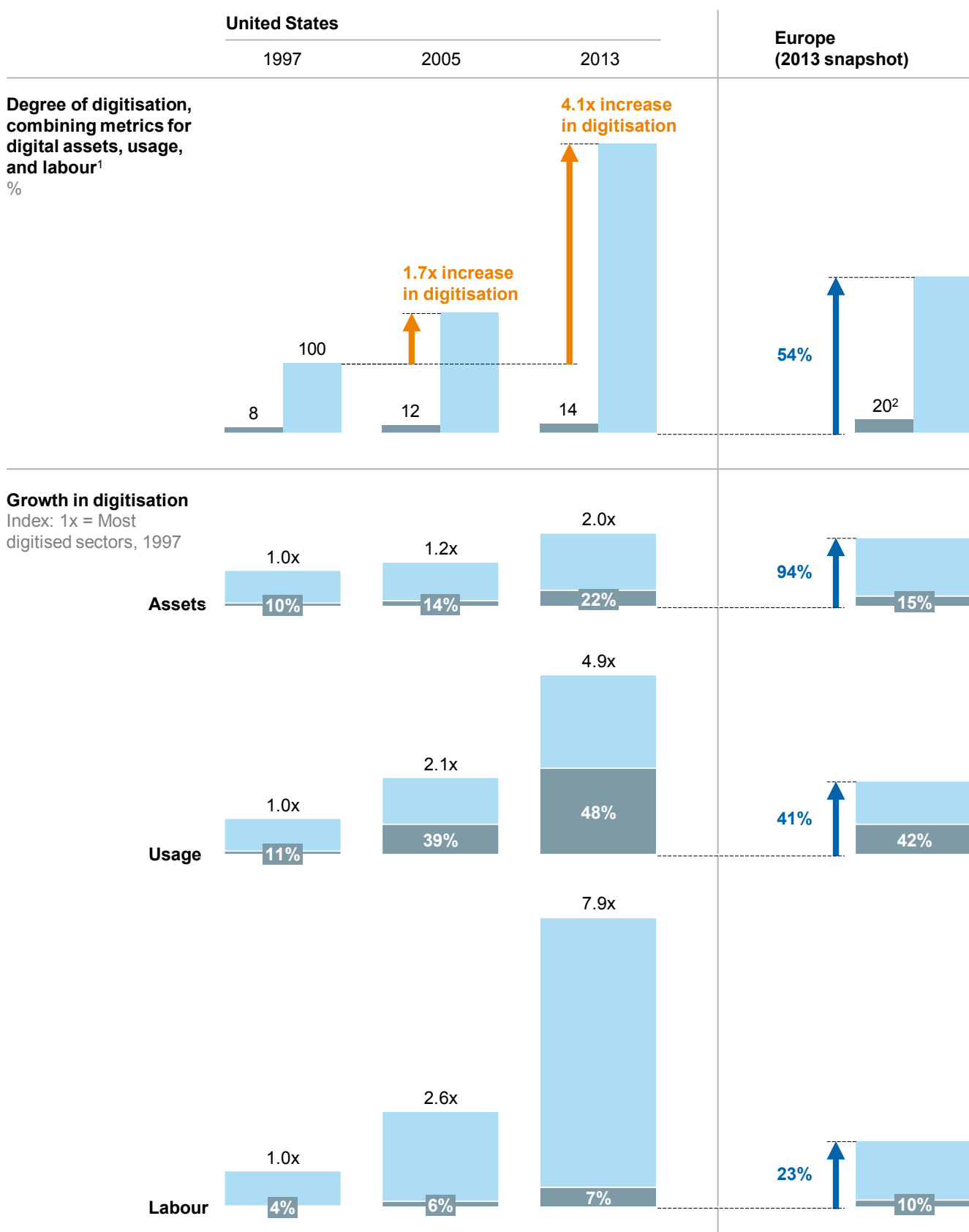
Across every indicator in the index, we can compare the most digitised sector with the rest of the economy to understand how the digital frontier is changing. Historical data are more readily available in the United States, and we can take a retrospective look at how the gap between leading sectors and the rest of the economy has grown (Exhibit 6). Relative to the digital leaders, the rest of the US economy was only 12 percent as digitised in 2005. Despite the rush of adoption since then, the rest of the economy is today still only 14 percent as digitised as the leaders. Relative to Europe's leading sector, the rest of Europe's economy is only 20 percent as digitised. Relative to US leaders, the rest of Europe (not including its ICT sector) is only 11 percent as digitised.

¹⁶ For this analysis, we define the digital frontier as the US ICT sector. Europe is defined here as the GDP-weighted average of six countries: France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom.

Exhibit 6

The most digitised sectors are maintaining a considerable lead over the rest of the US economy

Most digitised (1997 = 100) Rest of economy relative to leaders



1 Using a set of 18 historical metrics spanning digitisation of assets, usage, and labour.

2 Digitisation of rest of the economy is expressed as a function of the Europe, not US, frontier.

SOURCE: EU Klems; Eurostat; OECD; *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; McKinsey Global Institute analysis

The standard for what it means to be highly digitised today will be outdated by tomorrow, and the digital leaders will continuously devise new ways to use the technology. Over the past decade, for instance, as firms throughout the economy have started to embrace digital usage—engaging digitally with their customers, suppliers, and partners, for instance—the digital leaders have pushed the frontier by making large investments in digital capital to better equip their workers and redefine jobs and tasks for a more digitised workplace. This constant evolution of digital leaders means that, even as laggard firms and sectors try to close the gap, the frontier continues to move further ahead.

As a result, a new digital divide has opened up between digital haves and “have-mores”. In the United States, for instance, sectors with the strongest growth in digital intensity have also experienced the fastest growth in profit margins over the past two decades.¹⁷ And within these sectors, the margin spreads between the top-performing companies and the lowest performers are two to four times those in other sectors. In other words, the most digitised industries are developing a winner-take-all dynamic. But at the same time, digitisation seems to intensify competitive churn.¹⁸ Today’s market leaders are vulnerable to being knocked off by the next wave of innovation.

The correlation between growth in digital capability and growth in profit margins over recent decades is less clear in Europe than in the United States. Overall post-tax margins have grown steadily in both regions since the 1980s but have flattened out in Europe in recent years. One factor contributing to this divergence and weaker correlation may be that the US industries digitising most rapidly—including media, business services, and the ICT sector, which have posted very strong profit growth in the past decade—have tended to be net providers of digital content, designs, and platforms to the rest of the world, including Europe. This dynamic may be reinforced by the inherent network effects, low marginal costs, and hyperscale nature of successful digital businesses.

DIFFERENCES IN DIGITAL MATURITY EXIST EVEN BETWEEN LARGE EUROPEAN COMPANIES

The pattern of digital spread holds true at the sector level, but it must be acknowledged that successful, highly digitised firms are present even in digital laggard sectors. These instances show up on the European Industry Digitisation Index heat map. Some of these firms are born-digital startups seeking to disrupt a long-standing industry or commercial activity. Others are well-established incumbent firms in traditional industries that are successfully transforming themselves into digital giants.

For instance, Industry 4.0 champions in Europe are disrupting the manufacturing sector by leveraging connectivity, analytics, human-machine interaction, and digital-to-physical conversion such as 3D printing. In Germany, every manufacturing sector is affected by digital, from automotive to the chemical and pharmaceutical industries; digital champions are constantly developing innovative solutions. For instance, Siemens offers condition monitoring and predictive maintenance to its clients; Bosch uses RFID technology to enable autonomous transport systems; and the i3 plant in Leipzig built by BMW can be considered an early example of the smart automated plant archetype.¹⁹

As these examples suggest, digitisation capabilities vary significantly from company to company. In 2015, McKinsey surveyed 160 companies in 55 countries to measure their digital strategy, capabilities, and culture, and found a large gap separating the digital

¹⁷ Gary Pinkus, James Manyika, and Sree Ramaswamy, “The most digital companies are leaving all the rest behind”, *Harvard Business Review*, January 2016.

¹⁸ Andrew McAfee and Erik Brynjolfsson, “Investing in the IT that makes a competitive difference”, *Harvard Business Review*, July-August 2008.

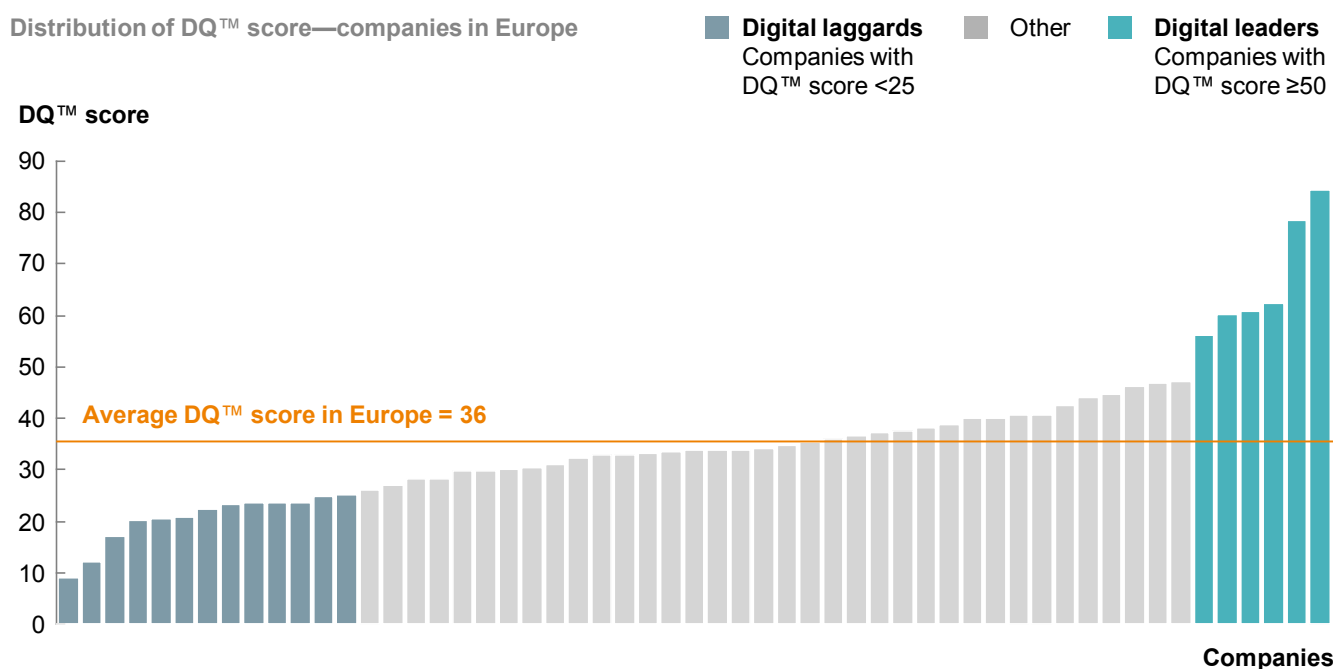
¹⁹ *Industry 4.0: How to navigate digitization of the manufacturing sector*, McKinsey & Company, 2015.

leaders—the top 10 percent or so—from the rest (Exhibit 7, which shows a European subset of these companies).²⁰

Exhibit 7

There is a persistent gap between firms with high Digital Quotient™ and all others

Distribution of DQ™ score—companies in Europe



NOTE: Assessment called Digital Quotient™ (DQ™) out of 100 to measure an organisation's digital maturity and capabilities, and how it drives financial performance.

SOURCE: McKinsey Digital Quotient company survey; McKinsey Global Institute analysis

These leaders are able to benefit in four key areas where digital technologies have an impact: improving operational efficiency, reaching and retaining customers, enabling better innovation and collaboration, and organising workforces more effectively.

Just as with sectors, the gap between firms on the digital frontier and those that lie some distance from it is not just about whether firms invest in information technology or not—most companies do. Rather, it reflects the degree to which, and how, digital assets are used, and the extent to which firms digitise their workplaces. For the best-performing firms, going digital is an opportunity to reinvent core processes, create new business models, and put the customer at the centre of everything. As we see in the US economy, highly digitised firms are also able to change the rules of competition by deploying digital assets to capture value, disrupting intermediaries, breaking apart value chains, and exploiting network effects and low marginal costs to gain hyperscale. When digitisation reaches critical mass across industries, it can spark fierce price competition, shifting profits, and competitive churn in commercial ecosystems.²¹ Digitally enabled innovations have powerful network effects with “winner-take-most” dynamics (see Box 1, “Redefining competitive dynamics”).

²⁰ McKinsey Digital Quotient analysis is a quantitative measure of a company's digital maturity, based on the specific management practices most correlated with positive digital and financial performance. DQ measures that maturity in four key areas: strategy, culture, organisation, and capabilities, isolating the subset of management practices that most contribute to financial and market success.

²¹ *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

Box 1. Redefining competitive dynamics

Digitisation is transforming competitive dynamics.¹ One arbiter of competitiveness in this new era is who develops the right digital assets.² All kinds of sectors are transitioning from physical to digital products and are building huge repositories of data. Even in traditional sectors, companies are increasingly focused on data, platforms, and connectivity as the keys to interactions, transactions, and innovation. As this shift continues, value is moving from physical intermediaries and asset holders to digital intermediaries and consumers. One way to understand how digital is disrupting sectors is to go back to the fundamental principles of supply and demand. This approach reveals two primary sources of digital transformation and disruption. The first is developing new markets where supply and demand change only to a moderate extent. The second is the dynamics of hyperscaling platforms where supply and demand shifts are much larger.³

Modest changes in demand and supply. Here, digital technology exposes sources of supply that were previously impossible or too costly for industry incumbents to provide. Digitisation gives customers more complete information and unbundles (or rebundles) aspects of products and services that had been combined (or kept separate) through necessity, convenience, or business strategy. New opportunities are opening up for specialised players as digitisation enables companies to split jobs into smaller parts, boosting efficiency and breaking value chains into parts.⁴ These two effects together give new market makers an opportunity to connect consumers and customers by lowering search and transaction costs and reducing information asymmetry. One example is France's BlaBlaCar, a long-distance ride-sharing service that connects drivers who have empty seats in their vehicles to people travelling to the same destination. Effectively, the company has brought existing cars into the market and uncovered demand from others to use them. Although little has changed in the underlying supply-and-demand forces, huge value has been created.

Extreme changes in supply and demand. Sometimes the shifts are large, created through new or significantly enhanced value propositions for customers enabled by reimagined business systems or through hyperscale platforms that lie at the centre of entirely new value chains and ecosystems. The low marginal costs and network effects of digital technologies create hyperscale advantages, enabling successful high-tech firms to achieve massive size at a speed that was impossible in the old world of physical assets. Facebook is one of the best-known examples; in just ten years, it had more active users per month than the population of China.⁵ Challenges to incumbents may come from adjacent markets or from digital companies with totally different business objectives. Established companies relying on elevated barriers to entry such as the high costs of physical infrastructure or regulatory protection will find themselves vulnerable. Users may demand a change in regulation, or attackers may find collaborative uses for expensive infrastructure. Physical assets can be virtualised, driving the marginal cost of production towards zero. Meanwhile, information is being embedded in goods and services, so that products themselves can be redefined. These forces blur the boundaries among industries. Companies that started as pure digital players have moved into retail, logistics, finance, and even the automotive industry. Extreme outcomes become a necessary part of companies' thinking.

¹ *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

² Jacques Bughin and James Manyika, "Measuring the full impact of digital capital", *McKinsey Quarterly*, July 2013.

³ Angus Dawson, Martin Hirt, and Jay Scanlan, "The economic essentials of digital strategy", *McKinsey Quarterly*, March 2016.

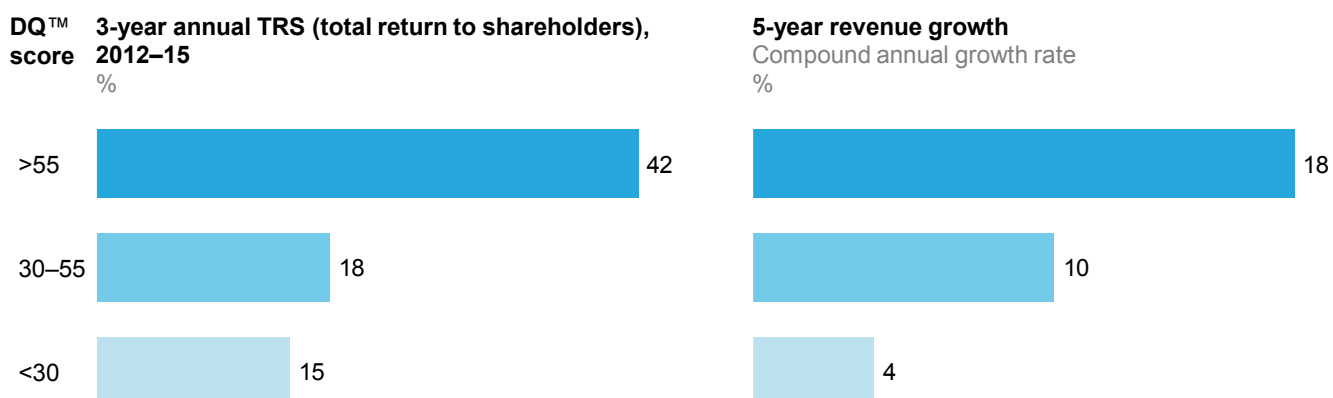
⁴ *An economy that works: Job creation and America's future*, McKinsey Global Institute, June 2011. Also see Thomas W. Malone, Robert Laubacher, and Tammy Johns, "The big idea: The age of hyperspecialization", *Harvard Business Review*, July-August 2011.

⁵ Facebook Annual Report, 2014.

The digital gains made by leading companies are correlated with stronger financial performance—measured by revenue growth and return to shareholders—and are sustained over time (Exhibit 8).²²

Exhibit 8

Companies with higher Digital Quotients perform better according to key financial metrics



SOURCE: McKinsey Digital Quotient analysis of 46 publicly traded companies; McKinsey Global Institute analysis

5%
Digital share of the
EU-28 economy

THERE ARE LARGE VARIATIONS WITHIN EUROPE IN THE EXTENT OF DIGITISATION; OVERALL, EUROPE IS LESS DIGITISED THAN THE UNITED STATES

Measured from the perspective of digital consumption across sectors, the digital economy accounts for 5.0 percent of EU-28 GDP today.²³ This share is driven primarily by private consumption (53 percent of the digital economy), followed by private investment (15 percent). But the European average hides a great deal of variation among countries (Exhibit 9). Northern European countries generally tend to have more digitised economies than southern ones. For instance, the digital economy accounts for 4.0 percent of GDP in Italy, 5.5 percent in France, and 6.9 percent in Sweden.

To take one example of differences between countries, the high digital share in the UK economy (nearly twice that of France or Germany) is mainly driven by private consumption, worth 6 percent of UK GDP, and public expenditure, worth 1.7 percent. These figures are two and three times the averages in other European countries, respectively. The difference in consumption is driven by factors such as the much larger share of e-commerce (43 percent higher in the UK than in France in 2013) and the difference in public expenditure, explained by the higher public investment in software and services. The US digital economy is 8 percent of the country's GDP, much higher than the EU-28 average of 5.0 percent. The difference between Europe and the US is primarily in private investment, which is significantly lower in European countries—in France, for instance, it is 2.6 percentage points lower than in the United States.

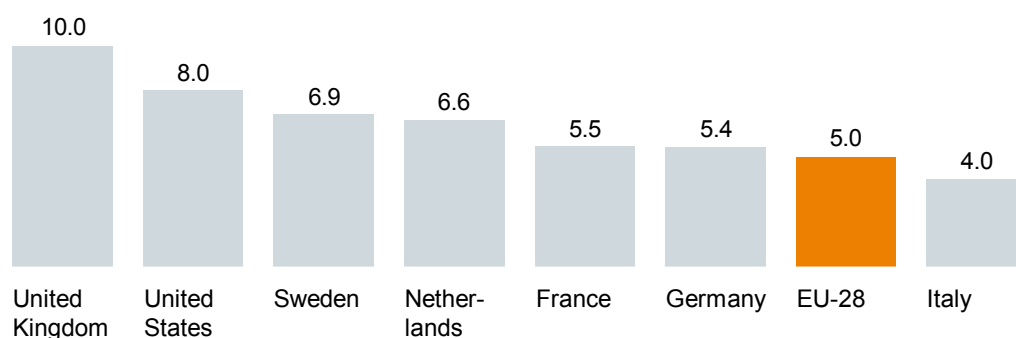
²² Tanguy Catlin, Jay Scanlan, and Paul Willmott, "Raising your Digital Quotient", *McKinsey Quarterly*, June 2015.

²³ The figures for digital share of GDP are based on an approach used in previous McKinsey and MGI research. See *Accélérer la mutation numérique des entreprises : un gisement de croissance et de compétitivité pour la France (Accelerating companies' digital transformation: A reservoir of growth and competitiveness for France)*, McKinsey & Company, September 2014; and *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity*, McKinsey Global Institute, May 2011. The analysis estimates the digital share of GDP in a granular way, estimating the digital share of household consumption, business investment, government expenditure, and net exports. Digital consumption by households, for instance, is calculated based on household spending on ICT, but it also includes spending on e-commerce, entertainment, online travel, and other internet-related consumption.

Exhibit 9

Europe's overall digitisation lags behind that of the United States, and there is significant variance among countries

Digital share of the economy
% of GDP



SOURCE: Eurostat; OECD; European Commission Joint Research Centre; McKinsey Global Institute analysis

Some EU countries are net digital exporters to Europe—but overall, Europe is a net importer from the United States. A large portion of the difference in digital share of GDP in each country is driven by the degree to which these services are developed at home rather than overseas. If we take a closer look at the share of digital services that are imported, we find differences even among countries that rank relatively high on overall digitisation. For instance, the Netherlands is a net exporter of digital services to the EU-28, running a trade surplus equivalent to 1.3 percent of Dutch services trade with the EU and the United States. In contrast, Italy runs a small deficit in digital services with the EU-28. Meanwhile, all EU countries import sufficient digital services from the United States to have net deficits in all cases (Exhibit 10). The EU-28, for instance, runs a digital services trade deficit with the United States amounting to 5.6 percent of EU-US trade in services. Overall, we find that much of Europe relies on imports of US technology for its own digital development (see Box 2, “Europe is dependent on the United States for the supply of digital assets”).

Ultimately, Europe does not rival the United States as a producer of global content, a creator of major platforms, or an incubator of successful internet companies. Measured by market capitalisation, for instance, there are no European firms in the 20 largest digital companies (Exhibit 11). The proliferation of digital “unicorns”—startups with billion-dollar valuation—has not occurred in Europe as broadly and to the same extent as it has in the United States. Leading European digital hubs, including Berlin, London, Paris, and Stockholm, tend to have fewer unicorns per vested company and relative to the leading US digital hubs such as Boston, Los Angeles, New York, and San Francisco.²⁴ Venture capital and growth investment in Europe are significantly lower as a share of GDP than in the United States, and there is enormous variation among European countries. For instance, these investments are four times as high in the United States as in Sweden, and ten times as high as in Germany.²⁵ Yet it is investment in R&D and digital infrastructure that will, to an extent, determine the speed of Europe's digitisation and its shape.

²⁴ MGI has looked at the number of unicorns relative to cities' populations and the number of unicorns among all companies funded by early seed capital. Stockholm performs very well on the first of these metrics, as London does on the second. Other than these two exceptions, Europe's top four digital hubs tend to have two to three times fewer unicorns per vested company and two to three times fewer unicorns relative to the population, compared to US hubs.

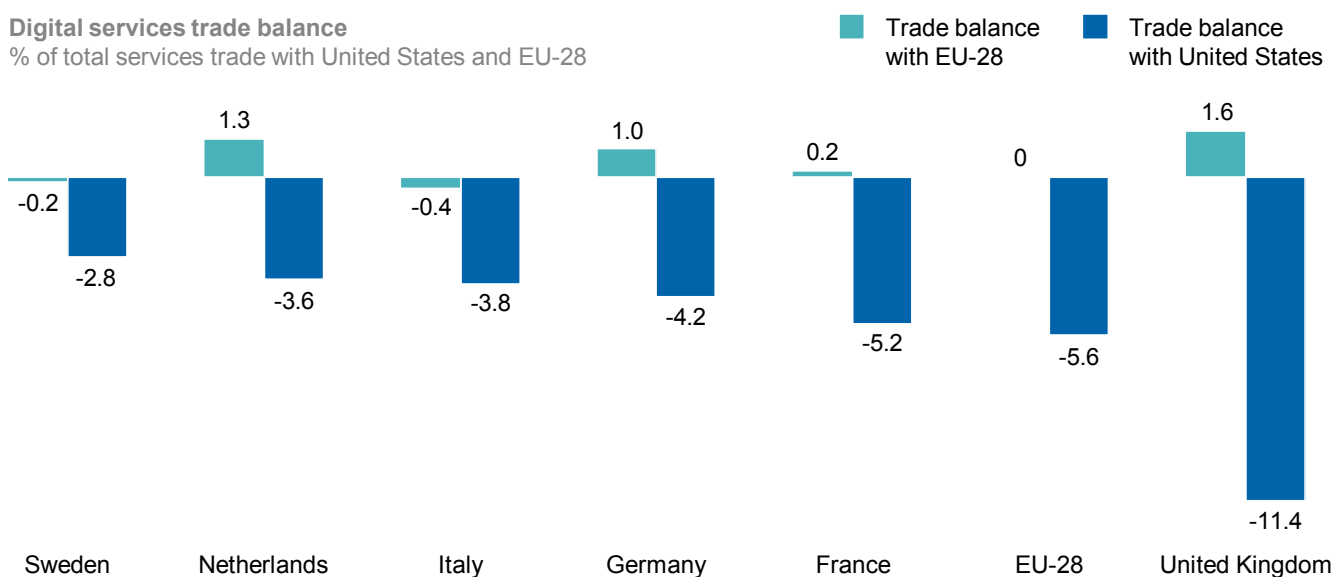
²⁵ *Secular stagnation and low investment: Breaking the vicious cycle*, McKinsey Global Institute discussion paper, April 2016.

Exhibit 10

EU countries are net importers of digital services from the United States

Digital services trade balance

% of total services trade with United States and EU-28



SOURCE: Eurostat; OECD; International Trade Centre; European Commission Joint Research Centre; CSIMarket; McKinsey Global Institute analysis

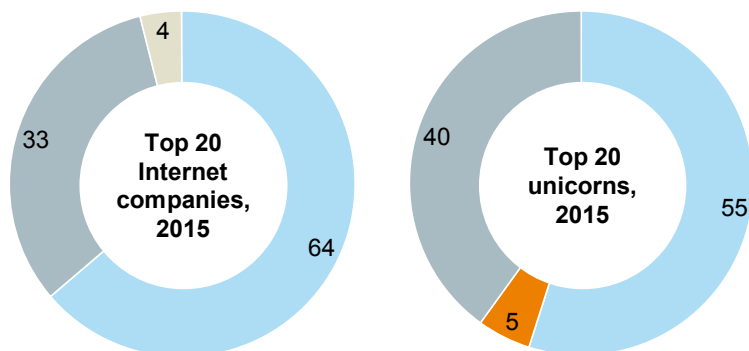
Exhibit 11

Europe lags in its ability to scale up unicorns, but there is reason for optimism with new technology companies

United States Western Europe China and India Japan and South Korea

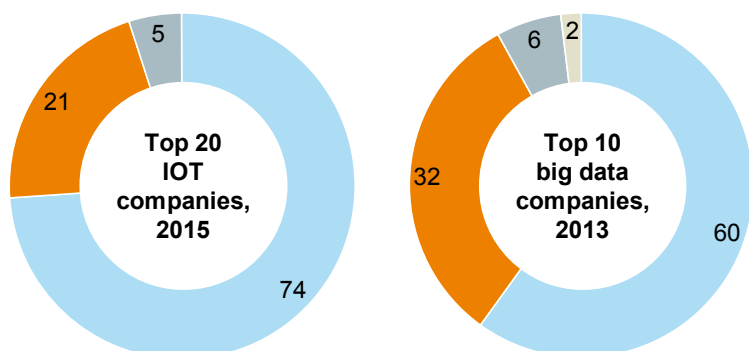
European firms had limited success by some measures of digital innovation ...

Market capitalisation %



... but are showing promise in the new wave of industrial digitisation

Revenue %



NOTE: Numbers may not sum due to rounding.

SOURCE: Statista; DB index; IOT Analytics; J.P. Morgan; McKinsey Global Institute analysis

Evidence suggests, however, that Europe's digitisation is moving in the right direction; when it comes to new digital technologies such as the Internet of Things and big data applications, European companies make up 20 to 30 percent of revenue among the largest firms. These technologies are at the forefront of a new wave of industrial and commercial applications of digital technologies, and their economic impact could be very large, as we will see in a later chapter. They are also applications that are most relevant in some of the sectors that are at a distance from the digital frontier, such as asset-heavy manufacturing or mining industries, and quasi-public sectors such as health care. The significant presence of European firms in these areas, and the policy focus by the European Commission on these areas, provides reason for optimism that the digital gaps within Europe, and between Europe and the United States, could narrow.

THE UNEVEN NATURE OF DIGITISATION ACROSS EUROPE IS DRIVEN BY VARIATIONS BETWEEN SECTORS AND BETWEEN COUNTRIES

The nature of the digital frontier is changing continuously. In the United States, finance was an early mover in investing in digital. Over the past 20 years, the use of digital technologies has pushed the digital frontier forward a considerable distance. In the past decade, industries that have rapidly digitised their workers—providing digital tools, creating new digital jobs, and digitally augmenting or replacing workers' tasks—have been nearer to that frontier. Not every company has been able to keep pace with these leaders, and they have fallen further behind.

Box 2. Europe is dependent on the United States for the supply of digital assets

Although many European countries rank relatively high on digitisation overall compared with the United States, the United States is the dominant supplier of digital technologies to the world, including Europe. Among all publicly listed companies in the global ICT sector (including IT hardware, software, and services), US-based firms account for nearly half of worldwide sales and two-thirds of post-tax profits. European firms generate only 17 percent of global revenue and 14 percent of worldwide profits. Of the 250 largest ICT firms in the world, 75 are from the US and 50 from Japan; EU-15 countries together account for only 45 firms in the list. Nevertheless, some European firms have been highly successful, becoming digital giants. Despite their smaller number, for instance, among the world's largest ICT firms, European companies account for 22 percent of sales, only slightly less than US firms' share of 30 percent.

Domestic consumption is the primary driver of digitisation in the European economy. However, the overall contribution of digital to GDP is reduced by the fact that Europe imports a significant amount of its digital capability. There are two broad types of such imports: digital hardware, primarily from Asia, and digital platforms, largely from the United States. The US digital economy also relies on hardware imports from Asia. Its homegrown digital platforms mean that the United States ranks high as a supplier of digital capabilities to the global and European economies.

One study notes that the share of online services imported from the United States is “very substantial” but that 32 percent of US online service providers export, and that these exports account for nearly twice as much as domestic demand. It notes that around 42 percent of all online services trade volume in the EU is domestic and that 54 percent comes from the United States. Moreover, about two-thirds of all EU online services suppliers do not operate in more than four countries.¹

¹ Georgios Alaveras and Bertin Martens, *International trade in online services*, Institute for Prospective Technological Studies Digital Economy working paper number 08, Joint Research Centre technical reports, European Commission, 2015.

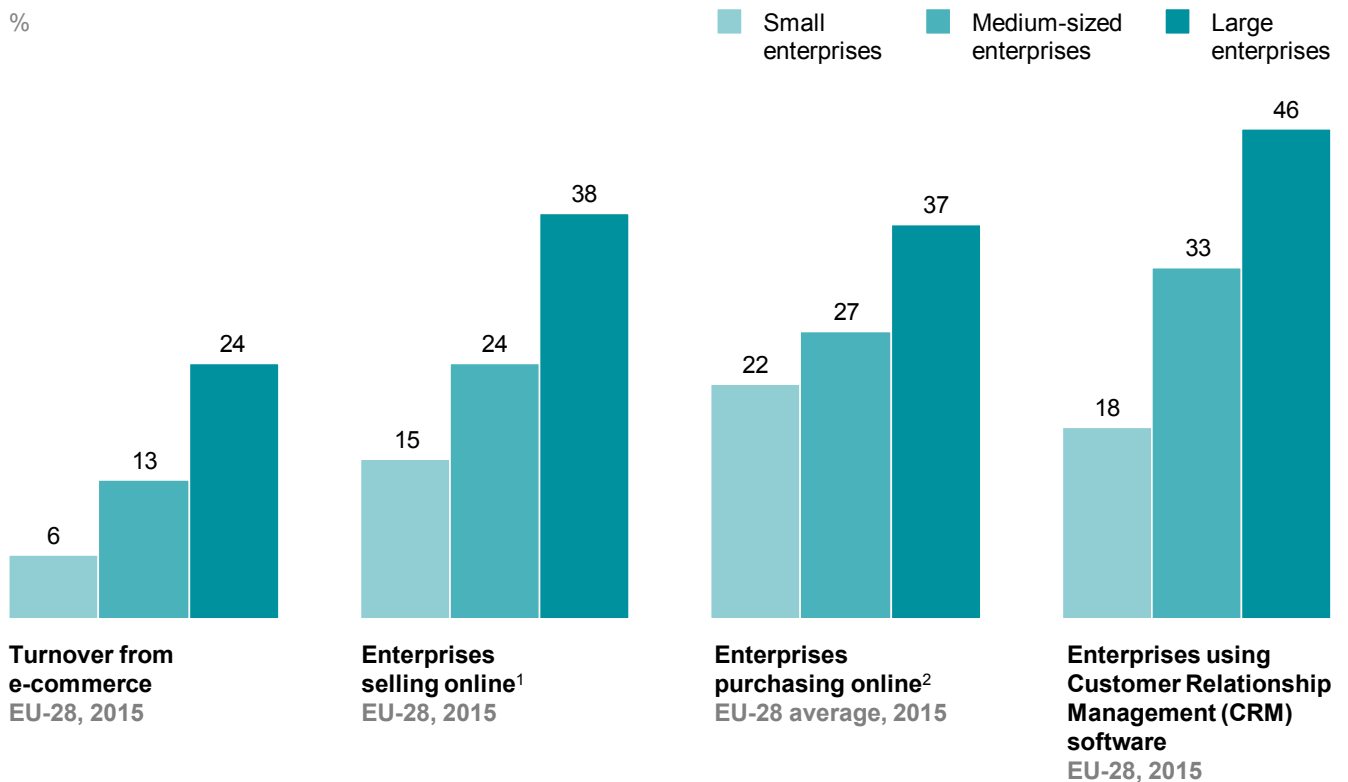
20-30%

of global IoT and big data revenues captured by large European firms

This raises the question of why some sectors digitised earlier, and more intensely, than others and have remained at the digital frontier over time. Several factors, such as operational complexity, knowledge and skill content, and the threat of competition, play a role.²⁶ One of the most striking factors is the share of large firms in a sector, because there are large gaps between the digital capabilities of large and small companies (Exhibit 12). Large firms, often dealing with several establishments, long supply chains, and more complex operations, tend to be more digitised than smaller firms. The extent to which large firms dominate a sector influences how the sector ranks in the Industry Digitisation Index. For instance, despite the fact that large retailers digitised early and have continued to stay at the forefront of digitisation, the retail sector ranks relatively low on the index because a long tail of small firms drags down the overall digitisation of the sector. This trend applies in the United States as well; large retailers are three times as likely as small ones to use digital payments. In less digitised sectors, the gap is even larger; in construction and health care, for instance, large US firms are eight to ten times as likely as small firms to use digital payments.

Exhibit 12

Within Europe, small and medium-sized enterprises lag behind large firms in digital adoption



- 1 Enterprises using any computer network for sales (at least 1%).
- 2 Enterprises using any computer network for purchases (at least 1%).
- 3 Excluding companies with less than 10 employees.

SOURCE: *Digital Agenda Scoreboard Dataset, European Union*; McKinsey Global Institute analysis

²⁶ The threat of competition can be due to exposure to global trade, deregulation, or other external factors. Actual competitive churn, measured by the rate of firm entry and exit in a sector, tends to be less correlated than the implied threat of competition. For a more detailed discussion of these factors, see *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

Despite the continuous evolution of the digital frontier, the same industries have tended to be at the frontier—and lag behind—in both Europe and the United States (Exhibit 13). Variance analysis indicates that the variation between different sectors within a single country is more than twice as large as that between different countries for a single sector. This demonstrates the powerful role a country's sector mix plays in the extent to which the country becomes digitised.

Exhibit 13

The same sectors tend to be at the frontier—and lagging behind—in the United States and Europe

**MGI Industry Digitisation Index,
United States vs. European nations¹**
Select sectors²

Relatively low digitisation  Relatively high digitisation

Sector	United States	United Kingdom	Germany	France	Netherlands	Italy	Sweden
ICT	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
Professional services	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
Media	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
Finance and insurance	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green
Wholesale trade	Dark Green	Dark Green	Dark Green	Dark Green	Dark Green	Yellow	Dark Green
Advanced manufacturing	Dark Green	Dark Green	Yellow	Dark Green	Dark Green	Yellow	Dark Green
Real estate	Yellow	Yellow	Orange	Yellow	Yellow	Yellow	Yellow
Government	Yellow	Yellow	Orange	Yellow	Yellow	Yellow	Orange
Retail trade	Yellow	Dark Green	Dark Green	Orange	Yellow	Orange	Dark Green
Basic goods manufacturing	Orange	Dark Green	Yellow	Yellow	Yellow	Yellow	Dark Green
Health care	Orange	Orange	Yellow	Orange	Yellow	Yellow	Yellow
Construction	Red	Yellow	Yellow	Yellow	Yellow	Orange	Orange

¹ Index is based only on asset and labour components and thus may not align with heat maps displayed elsewhere.

² Due to accounting differences between the United States and Europe, not all sectors can be fairly compared.

SOURCE: McKinsey Global Institute analysis

However, it also shows that the country can have a notable effect on the digital status of sectors. For instance, since large firms tend to be more digitised than small ones, it follows that the countries that have a smaller average firm size may be further away from capturing the full potential of digitisation. Large firms (with more than 250 employees) account for over 60 percent of employment in the United States, and more than half in the United Kingdom, but only about 30 percent in Italy. Microenterprises (with fewer than ten employees) make up only 8 percent of employment in the United States, but 18 percent in Europe.²⁷ While some sectors have an inherent ability to embrace digital transformation, countries can also enact policies to accelerate this trend.

²⁷ These percentages refer to surviving firms (i.e., companies that are at least three years old), and therefore exclude new entrants and companies that survive less than three years. See Albert Bravo-Biosca, *A look at business growth and contraction in Europe*, Nesta working paper number 11/02, December 2011.





3. EUROPE'S DIGITAL TRANSITION IS POISED TO HAVE SIGNIFICANT ECONOMIC IMPACT

Because Europe is in the relatively early days of its digitisation journey—and digitisation is so uneven—the economic benefits are not yet clear. However, we are already seeing some economic impact. There is some correlation between the digital intensity of sectors and their productivity. The impact on the labour market and the world of work is mixed. On the one hand, automation is displacing many tasks that were performed by individuals; on the other, digital technologies are making it easier for companies to match skills with the jobs they need doing, and opening up new opportunities for individuals to work more flexibly. Consumers, on the whole, benefit enormously from the digital revolution, but the most digitally savvy capture the largest benefits.

Overall, Europe could add €2.5 trillion (\$2.8 trillion) to its GDP in 2025, lifting GDP 10 percent above baseline projections for that year, if it were to accelerate digitisation. Laggard sectors from manufacturing to public services such as health care and education would need to double their digital intensity to make those economic gains a reality.

WHILE LINKED AT THE COMPANY LEVEL, DIGITISATION AND PRODUCTIVITY ARE NOT YET CLEARLY ASSOCIATED AT THE ECONOMY LEVEL

The link between productivity and digitisation is a matter of ongoing debate in advanced economies. In the United States, the acceleration of digitisation—particularly in the digitisation of workforces in digital frontier sectors—has coincided with a sharp slowdown in overall productivity growth in the economy in the past decade. Some believe that the productivity decline is real, and that greater digital innovation, particularly the consumer-driven variety, has no impact on efficiency gains.²⁸ But others have attempted to resolve this new “productivity paradox”. One possible explanation is the introduction of new errors in the measurement of prices for ICT goods such as semiconductors. Another may be the rapid growth in the past decade of consumer surplus specific to digital platforms such as Skype, Google, and Amazon, along with the proliferation of the “app economy” on mobile platforms such as Android and Apple iOS. Yet another may be the time lag—ten to 12 years—that firms experience from when they invest in new technology to the efficiency gains they reap from that investment.²⁹

This debate applies to Europe, too—with some key differences. The ICT sector, the supplier of digital tools and technologies to the economy, remains a major contributor to productivity growth in both Europe and the United States, though less so during the ongoing productivity slowdown.³⁰ But the ICT sector has had a much lower impact on productivity growth in Europe than in the United States.³¹ This may be linked to the fact that, as we show with the Industry Digitisation Index analysis, the ICT sector in European countries significantly

²⁸ Productivity growth among firms in the United States has fallen by two-thirds recently despite ongoing digitisation, prompting some to question the hype surrounding digital and productivity. For sceptics on productivity and digital, see, for instance, Robert J. Gordon, “US productivity growth: The slowdown has returned after a temporary revival”, *International Productivity Monitor*, number 25, spring 2013; Robert J. Gordon, *Is US economic growth over? Faltering innovation confronts the six headwinds*, NBER working paper number 18315, August 2012; and Tyler Cowen, *The great stagnation: How America ate all the low-hanging fruit of modern history, got sick, and will (eventually) feel better*, Dutton, 2011. However, it may be that economic statistics do not adequately measure the consumer surplus flowing from productivity gains.

²⁹ Erik Brynjolfsson and Lorin M. Hitt, “Computing productivity: Firm-level evidence”, *Review of Economics and Statistics*, volume 84, number 4, November 2003.

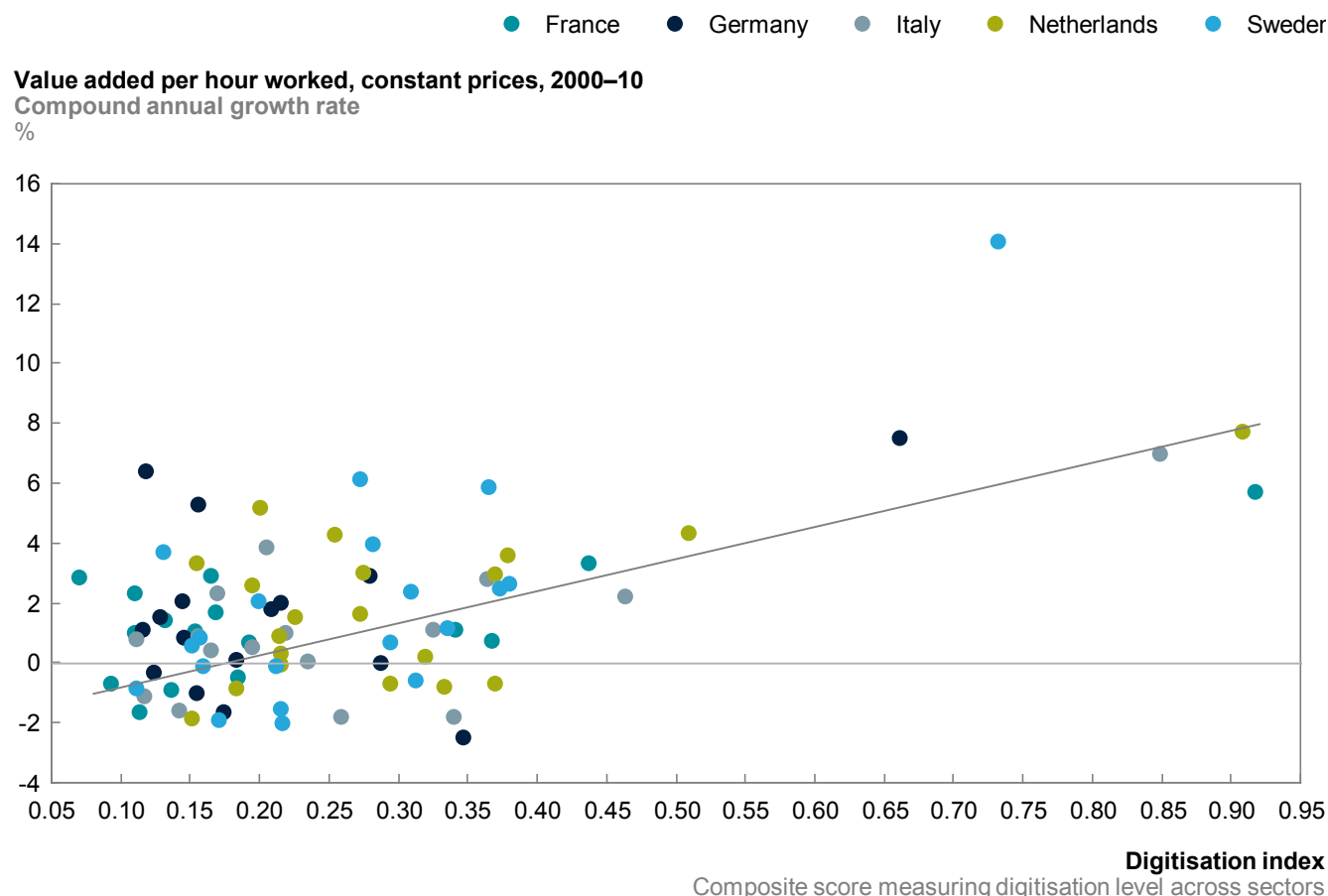
³⁰ Carol Corrado and Kirsten Jäger, *Communication networks, ICT and productivity growth in Europe*, The Conference Board Report for Telefónica SA, 2014.

³¹ Bart van Ark, *Productivity and digitalisation in Europe: Paving the road to faster growth*, The Lisbon Council and The Conference Board policy brief, 2014.

lags behind the US ICT sector in terms of its digital asset base, usage, and labour. More broadly, it may also be linked to the dependence of Europe's overall digital economy on US digital capability, which is supplied by the US ICT sector. The gap between the European and US digital frontiers, and Europe's reliance on US digital capability, may help explain another difference between US and European productivity growth. In the United States, the productivity growth in the past decade of sectors with high digital intensity according to the index—ICT, media, finance, and business services—is four times that of the rest of the economy.³² The same sectors show up as being the most digitised in Europe (Exhibit 14).

Exhibit 14

Most digitised sectors experience faster productivity growth compared to less digitised sectors



SOURCE: STAN Database for Structural Analysis (ISIC Rev. 4); OECD; McKinsey Global Institute analysis

There are, however, some similarities in the European and US productivity paradoxes. Many European firms are digital leaders, and their digital capabilities are at the same level—at the digital frontier—as those of leading US firms. Recent Organisation for Economic Co-operation and Development (OECD) research shows that when it comes to productivity, a similar gap exists between firms on the productivity frontier and all other firms, and European firms are on the productivity frontier along with US firms.³³ The aggregate productivity slowdown could thus reflect a slowing diffusion of productivity gains from the frontier through the rest of the economy—not an issue with the frontier itself. The OECD research also suggests that firms at the global productivity frontier have better digital capabilities (for instance, to manage their global value chains and multinational affiliate activity), hinting at a correlation between the digital frontier and the productivity frontier.

³² *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

³³ *The future of productivity*, OECD, 2015.

However, European firms on the productivity frontier may be substantially smaller than US frontier firms. This reflects not just a more efficient allocation of resources to productive firms in the United States, but also a preponderance of small firms in Europe. This latter outcome is partly a result of poorer scale-up opportunities in Europe than in the United States, leaving European countries with a larger share of smaller, older firms.

These differences point to the need for European firms to catch up to the productivity and digitisation frontiers, and for frontier firms to benefit from scale-up opportunities in the form of seamless domestic markets and access to fast-growing global markets. Thanks to scale-up opportunities in the domestic and global markets, established US manufacturing firms (those that are at least ten years old) can be more than seven times as large as new firms (those that are less than two years old), measured by number of employees. This ratio of the size (in terms of employment) of established firms to new firms is considerably lower for Europe's manufacturing sector: 3.5:1 in Sweden, 2.0:1 in Italy, and less than 2.0:1 in France. Similar trends are seen in the case of service-sector firms, too, although services firms tend to be smaller than manufacturing firms on average.

In the past decade, the productivity gap between frontier firms and all other firms has widened. So has the digitisation gap between the most digitised firms and the rest—partly because of a widening gap between frontier industries and others in terms of the digitisation of the workplace, but also because of a persistent gap between the digital capabilities of frontier firms and all others.³⁴ The productivity challenge for Europe may well be for its digital laggards to close the distance they have to travel to that digital frontier. But there is reason for optimism. Potential productivity gains from digitisation in laggard sectors are very large, particularly in sectors that are asset heavy, quasi-public, non-tradable, or some combination of those—especially as these sectors narrow the gap to the frontier in terms of their digital usage and a more digital workforce. Eventually, as digitally enabled changes to processes, organisational structures, supply chains, and business models become broad-based within and across sectors, the effect could be substantial enough to register as productivity gains at the sector and economy level.³⁵

DIGITISATION HAS A MIXED IMPACT ON THE WORLD OF WORK, WITH MORE POLARISATION AND MORE RAPID DISLOCATION BUT ALSO MORE OPPORTUNITIES

Automation inevitably has replaced many human functions, especially production and transactional jobs that are easier for computers to undertake, evidence from the United States shows (Exhibit 15). Digitisation is creating polarisation in the workforce. In France, for instance, one study concluded that technology is the “main driving force” of such polarisation. In non-manufacturing firms, technology strongly increases employment shares of top managers and decreases the shares of office and retail workers. In manufacturing, technology causes an increase in employment shares of relatively well-paid midlevel professionals and a decrease in shares of supervisors who are closer to the middle of the wage distribution, and of office workers. At the same time, the study found, technology causes significant skill downgrading among blue-collar workers.³⁶

2:1

Size ratio of established to new firms in Italy, vs.

7:1

in the United States

³⁴ *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015. Also see Tanguy Catlin, Jay Scanlan, and Paul Willmott, “Raising your Digital Quotient”, *McKinsey Quarterly*, June 2015.

³⁵ See Martin N. Bailey and James Manyika, *Reassessing the Internet of Things*, Project Syndicate, August 2015, and Michael Spence, *Automation, productivity, and growth*, Project Syndicate, August 2015.

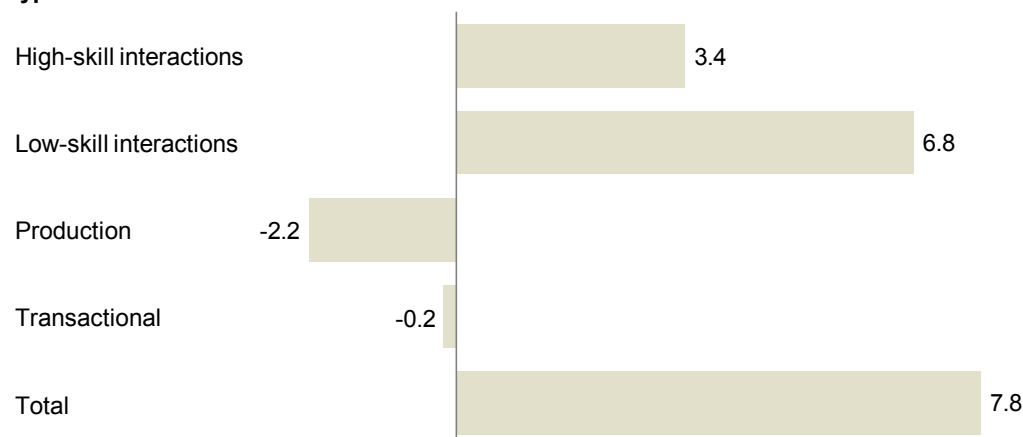
³⁶ James Harrigan, Ariell Reshef, and Farid Toubal, *The march of the techies: Technology, trade, and job polarization in France, 1994–2007*, NBER working paper number 22110, March 2016.

Exhibit 15

Automation has already affected production and transactional work

Change in number of full-time-equivalent workers, United States, 2000–14
Million

Type of work



SOURCE: *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016; McKinsey Global Institute analysis

MGI has looked at the potential impact of automation on clerical, sales, production, and operational roles—the middle-skill segment of the workforce—in the United States.³⁷ Jobs requiring high skill levels have been less affected thus far because they tend to require interpersonal skills, creativity, and decision making that are difficult to replicate using machines. Low-skilled jobs, too, have been relatively insulated because they tend to be service jobs performed face-to-face with customers; examples include restaurant workers, caregivers, and security guards. However, all skills levels are likely to be affected in the future, previous McKinsey research has found. As many as 45 percent of the activities individual are paid to perform can be automated by adapting currently demonstrated technologies. Even the highest-paid occupations, including physicians and senior executives, have a significant amount of activity that can be automated.³⁸

Our expectation is that this polarisation will accelerate (Exhibit 16). In the United States, MGI research suggests that the displacement of medium-skilled jobs by automation could accelerate to nearly twice the rate in recent decades. Based on different adoption curves, we find that automation could displace anywhere from 10 to 15 percent of these jobs in the decade ahead. The median point of our scenario is 13 percent, which would represent a sharp acceleration of historical displacement rates.³⁹ This does not necessarily mean there will be 13 percent fewer middle-skill jobs overall, as technology will simultaneously create new tasks and jobs at a rate we cannot predict.

³⁷ We analysed a detailed list of tasks performed by these workers and considered which ones could be automated by currently demonstrated technologies. We then mapped these tasks to jobs to estimate the share of employment that would be affected, applying historical adoption rates of comparable technologies. This approach considers only what is possible from a technological perspective, not whether this shift will be economically viable. For more detail, see *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

³⁸ Michael Chui, James Manyika, and Mehdi Miremadi, “Four fundamentals of workplace automation”, *McKinsey Quarterly*, November 2015.

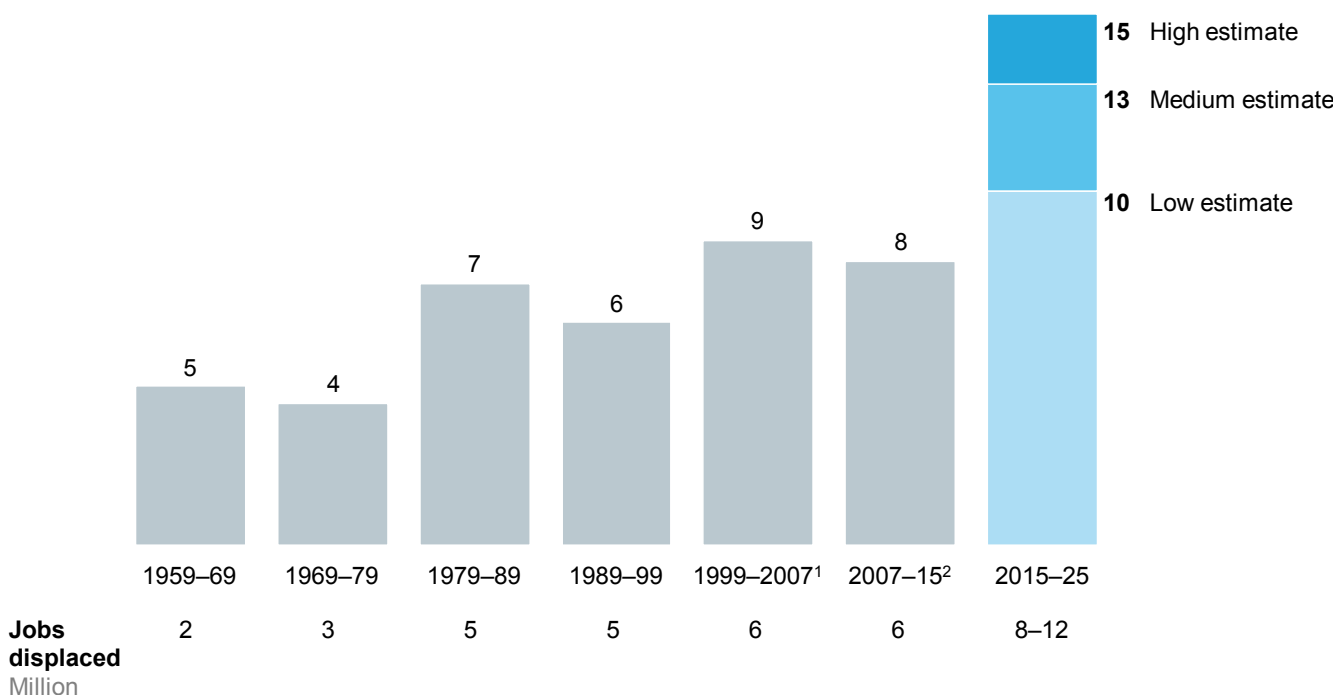
³⁹ These historical displacement rates are based on Daron Acemoglu and David Autor, “Skills, tasks and technologies: Implications for employment and earnings”, in *Handbook of Labor Economics*, volume 4, part B, Orley Ashenfelter and David Card, eds., Elsevier, 2011.

Exhibit 16

The displacement of middle-skill jobs due to automation could accelerate to nearly twice the rate of recent decades

Share of middle-skill jobs displaced in the US economy

%



¹ Normalised to 10 years and adjusted for the 2008 recession.

² Extrapolated 2015 total and middle-skill employment based on trends through 2014.

SOURCE: US Bureau of Labor Statistics; O*NET; Katz and Margo, 2013; Acemoglu and Autor, 2010; Brancheau and Wetherbe, 1990; McKinsey Global Institute analysis

We expect the same trend to unfold in Europe, albeit with some differences among countries. Some countries, including Sweden, have already spent a comparatively large percentage of GDP on ICT, suggesting that they have already automated many tasks. Finally, the structure of an economy counts. For instance, economies that are reliant on manufacturing where there are tremendous opportunities for further automation are likely to experience a greater impact.

But digital technologies also provide workers with new opportunities that can mitigate the impact on jobs. Digital tools such as broadband, cloud computing, voice over internet protocol phones, internal social networking platforms, file sharing, and video conferencing can help people work more efficiently from wherever they happen to be. The so-called “gig economy” in which individuals can showcase their skills and availability to employers in a digital marketplace offers new forms of flexibility and marketability in the job market—but is also a sign of a new precariousness in the world of work as digital technologies deepen their impact on labour (see Box 3, “The gig economy”)⁴⁰

⁴⁰ We define the gig economy—also known as the sharing economy—as contingent work that is transacted on a digital marketplace. Hence, it excludes ongoing part-time employment and freelance work that is not contracted on an online talent platform.

€350B
Potential GDP
impact of online
talent platforms
in Europe

Online talent platforms, including websites that aggregate individual résumés with job postings from traditional employers, as well as rapidly growing digital marketplaces could have significant benefits in three ways: boosting participation in the labour market, reducing unemployment, and raising productivity. A key advantage of such platforms is that they can better match the skills people have with the jobs that are available, and provide companies with the skilled workers they need.⁴¹ Even if such platforms were to enable only a fraction of the European workforce, we estimate that these platforms could add as much as €350 billion (\$390 billion) to GDP (Exhibit 17).⁴²

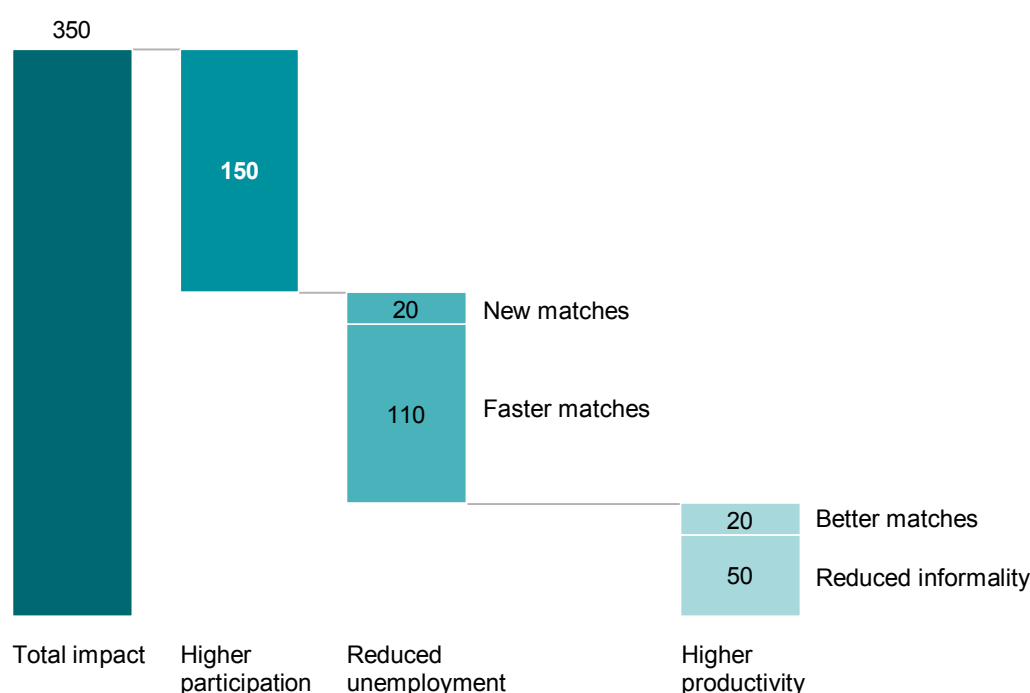
Exhibit 17

Online talent platforms will generate large GDP savings by improving labour-market efficiency

The impact of online platforms on European GDP can be as high as €350 billion

GDP contribution of online platforms to the European economy, 2025¹

€ billion



1. Based on extrapolations, all European countries included.

NOTE: Numbers may not sum due to rounding.

SOURCE: *Connecting talent with opportunity in the digital age*, McKinsey Global Institute, June 2015; McKinsey Global Institute analysis

⁴¹ MGI estimated that up to 540 million people around the world could benefit from these platforms by 2025. As many as 230 million could find new jobs more quickly, reducing the time spent unemployed, and 200 million people who are inactive or work part time could work more paid hours through freelance platforms. As many as 60 million people could find work more closely suited to their skills and preferences, and an additional 50 million could shift from informal to formal employment. Companies can use their platforms not only to identify and recruit candidates but also to motivate them and improve their productivity once they are in work. MGI has calculated that adoption of these platforms could increase the output of companies by up to 9 percent and reduce the cost of recruiting talent by as much as 7 percent. Based on increased transparency of the demand for skills, young people can make educational choices that better match the jobs that are likely to be available to them. MGI found that more effective spending on tertiary education could reduce some of the \$89 billion misallocation in Brazil, China, Germany, India, Japan, the United Kingdom, and the United States.

⁴² For a global discussion on this point, see *A labor market that works: Connecting talent and opportunity in the digital age*, McKinsey Global Institute, June 2015.

GAINS TO CONSUMERS ARE UNEVEN, TOO

Digital platforms such as Amazon, Google, Skype, and Wikipedia have all climbed the adoption S-curve since the early 2000s, creating a rapidly increasing surplus to consumers. For instance, in 2013, Skype accounted for nearly 20 percent of long-distance calls, producing a surplus to consumers of an estimated €34 billion (\$37 billion); since 2005, the cumulative surplus created by this one platform is in the region of €137 billion (\$150 billion) (Exhibit 18). McKinsey found that the consumer surplus created by the mobile internet in the United States and Europe doubled from €130 billion in 2010 to €250 billion in 2013.⁴³ But the consumer surplus from such digital platforms is not widely shared. According to one report, the 20 percent of consumers who are the most digitally savvy capture 60 percent of the entire surplus that such platforms create.⁴⁴ The typical person using a smartphone for communication, entertainment, or basic searches is not taking advantage of the full range of applications that produces real efficiencies.

⁴³ See Jacques Bughin, “The Internet’s €100 billion surplus”, *McKinsey Quarterly*, January 2011; and Jacques Bughin and James Manyika, “The mobile Internet’s consumer dividend”, *McKinsey Quarterly*, February 2014.

⁴⁴ *Consumers driving the digital uptake: The economic value of online advertising-based services for consumers*, IAB Europe, September 2010.

Box 3. The gig economy

The gig economy has become a more prominent feature of the labour market in recent years through such platforms as Monster.com, LinkedIn, Upwork, and Taskrabbit. These online talent platforms connect freelance, or contingent, workers, with specific tasks or assignments. Companies can use these platforms to call in specialists for assignments at short notice. Upwork, for instance, now connects an estimated four million businesses with more than nine million freelancers in 180 countries. A growing number of these platforms specialise in a particular type of service—Uber, Lyft, and Sidecar for taxi services, and UrbanSitter and Care.com for child care.

Nevertheless the numbers of people working in the gig economy remain small. MGI has estimated that the number of people who find work on such platforms is less than 1 percent of the US working-age population.¹ This is roughly in line with other estimates. One study put the number of people providing services through online intermediaries at only about 0.5 percent of workers in the United States in 2015.²

While the gig economy provides new opportunities to freelancers, it also requires a change in how we think about traditional work-related benefits. The status of freelancers in the gig economy remains precarious. Many of the people participating in contingent work do so because this is their only option; many, too, use these platforms to supplement income from other jobs. Workers are particularly vulnerable to regulatory changes, have fewer rights to social protection, have limited career progression, and lack access to credit.³ In 19 out of 34 OECD countries, self-employed workers are not eligible for unemployment benefits, and in ten of these countries, they are not eligible for work injury benefits.⁴ To capture the full potential of the gig economy may require regulators to revisit the treatment of such contingent workers.

¹ *A labor market that works: Connecting talent with opportunity in the digital age*, McKinsey Global Institute, June 2015.

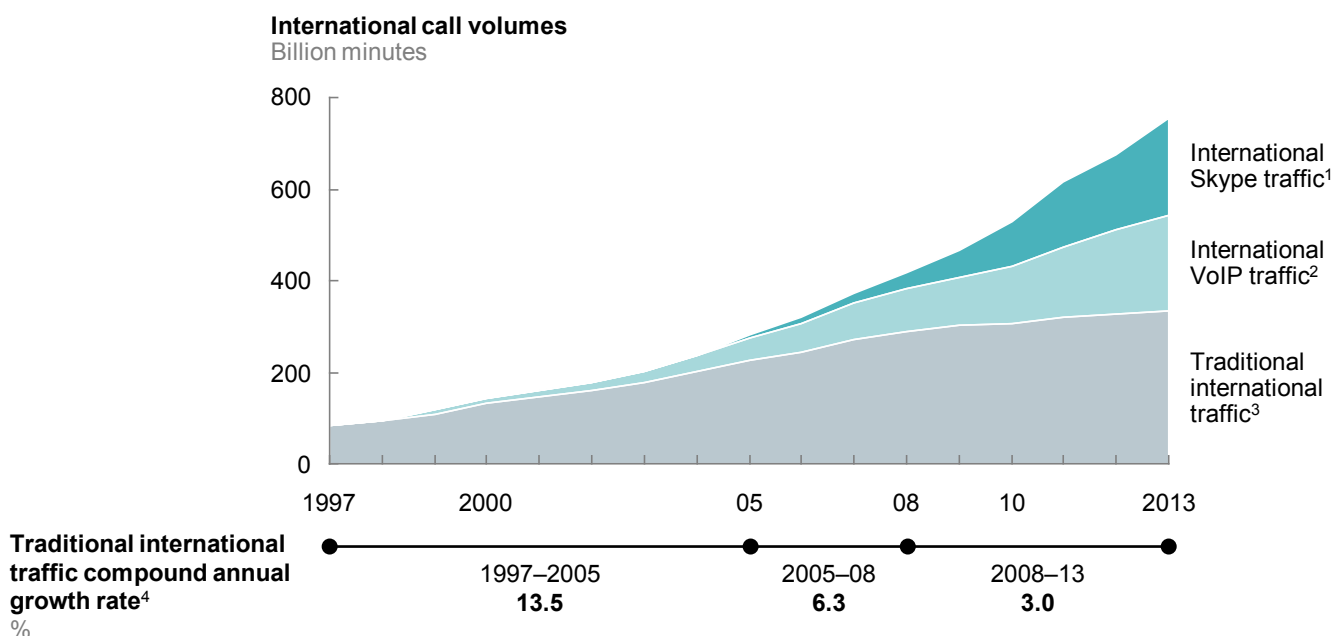
² Lawrence F. Katz and Alan B. Krueger, *The rise and nature of alternative work arrangements in the United States, 1995–2015*, March 29, 2016.

³ *A labor market that works: Connecting talent with opportunity in the digital age*, McKinsey Global Institute, June 2015.

⁴ OECD, *Automation and independent work in a digital economy*, policy brief, May 2016.

Exhibit 18

Digital players such as Skype disrupt traditional business models and shift huge value from incumbents to consumers



1 International Skype-to-Skype calls, including video calls.

2 International VoIP-transported calls, including Skype-to-phone calls, excluding PC-to-PC and Skype-to-Skype calls. VoIP is Voice over internet protocol.

3 International TDM-carried calls (time-division multiplexing, traditional means for international calls transfer).

4 Assuming average 2013 price of \$0.17 per minute for an international phone call.

SOURCE: TeleGeography; McKinsey Global Institute analysis

2x

Increase in digital intensity for laggard sectors to achieve €2.5 trillion GDP boost by 2025

THE IMPACT OF DIGITISATION ON PRODUCTIVITY, CAPITAL, AND LABOUR COULD DELIVER €2.5 TRILLION OF ADDITIONAL GDP TO EUROPE IN 2025

Europe could gain an additional €2.5 trillion (\$2.8 trillion) of GDP in 2025 through further digitisation (Exhibit 19). This would lift European GDP 10 percent above baseline projections for that year. But achieving this impact will require an acceleration of digital transformation, particularly in sectors that are not on the digital frontier—including asset-heavy sectors such as manufacturing and logistics, quasi-public sectors such as health care and education, and local, fragmented sectors such as hospitality and construction. These sectors will need to double their digital intensity, as measured by our European Industry Digitisation Index.

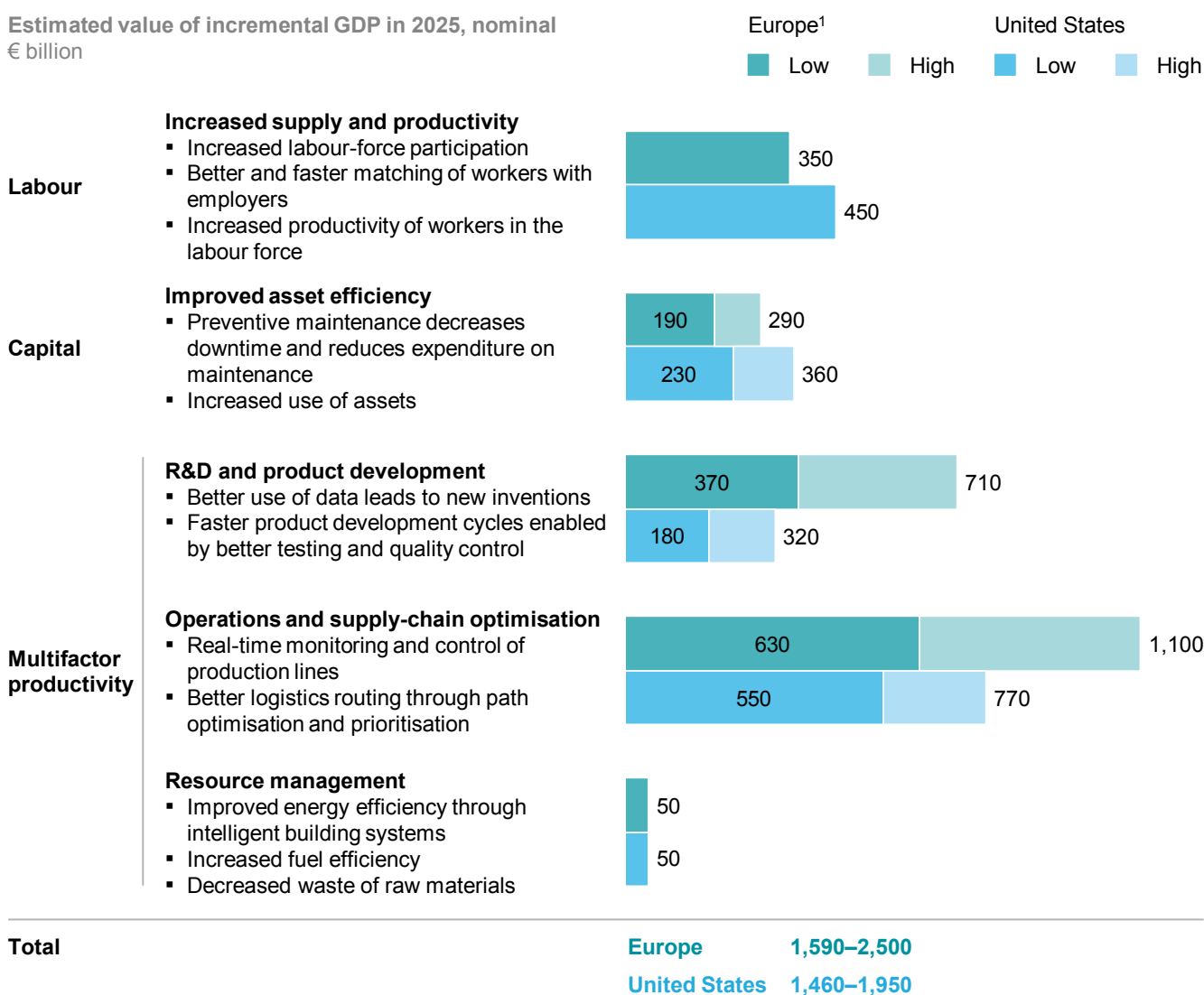
This estimate of GDP impact is based on innovations that are already spreading through the European economies and have the potential to offer substantial economic benefits in the near future. In reality, the potential boost to GDP is likely to be much greater as the digital frontier continues to move forward at a rapid pace. Additionally, the consumer benefit may be much bigger but cannot yet be quantified. Because digital in Europe remains below its potential, as we have noted, its impact is hard to measure, may come with a lag, and is difficult to disentangle from other economic factors. In addition, these estimates of the additional GDP potential assume that companies and workers are able to capture the gains accruing from digital-related efficiency advances in the form of higher profits and wages. Alternatively, the efficiencies may instead be competed away to consumers and not show up in measured GDP.

The GDP impact is likely to be realised by several digital technologies spreading across many sectors of the European economy. An estimated €350 billion (\$390 billion) of GDP, as we discussed, could be secured by the use of digital technologies to increase the supply of labour and its productivity.

Exhibit 19

Managing the transition to more digitisation could add up to €2.5 trillion to Europe's GDP in 2025

Estimated value of incremental GDP in 2025, nominal
€ billion



¹ Includes EU-28 countries.

SOURCE: *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015; McKinsey Global Institute analysis

Moreover, boosting capital productivity—the efficiency of physical assets—by more extensive use of the Internet of Things could contribute a GDP boost of between €190 billion (\$210 billion) and €310 billion (\$340 billion). Production downtime in factories can be reduced, for instance, by using applications that signal when machinery needs preventive maintenance. In transportation, vehicles connected to the internet can gather real-time data from on-board sensors that help operators to remotely manage and maintain the vehicles. Condition-based maintenance could reduce maintenance spending by 10 to 40 percent for air carriers, by shifting from rules-based maintenance routines to predictive maintenance based on actual need, which is made possible by real-time monitoring. In custom production environments such as mining, oil and gas, and construction sites, Internet of Things sensors will help to monitor the health of machinery in real time in remote and difficult-to-access zones.

Finally, the largest contribution to GDP would come from the positive impact of data analytics and the Internet of Things on productivity—an estimated total of €1.0 trillion to €1.9 trillion (\$1.1 trillion to \$2.0 trillion). The largest GDP potential would come from

optimising operations and supply chains through, for instance, real-time monitoring and control of production lines, and better logistics routing. Large retailers aim to better manage their inventory, to drive more streamlined and cheaper store operations using big data, localisation, and product tracking technologies. Big data may reveal further opportunities to increase yield even within manufacturing operations that are considered best in class. In a factory of a European chemical company, for instance, the use of neural-network techniques—a form of advanced analytics based on the way the human brain processes information—to measure and compare the relative impact of different production inputs on yield helped to identify unexpected insights. By resetting the parameters accordingly, the chemical company was able to reduce its waste of raw materials by 20 percent and its energy costs by around 15 percent.⁴⁵ The opportunities are tremendous and everywhere, especially in asset-heavy sectors that are making digital investments but are still catching up on digital usage. In the oil and gas industry, for instance, less than 1 percent of the data being generated by the 30,000 sensors on an offshore oil rig is incorporated into the process workflow to improve throughput.⁴⁶

The second-largest potential source of enhanced productivity would be using digital technologies to enhance research and development. The availability of large pools of data and the ability to analyse them not only helps to speed up the advancement of new inventions but also cuts the time it takes to develop new products because digital technologies enable improved testing and quality control. Computer-aided product design and data generated from production systems help engineers to design next-generation products with a leaner approach to costs and raw material use. Using big data and leveraging 30 different data sources that stretched back over five years, an automotive manufacturer identified an 18 percent reduction in time to market and 11 percent cost reduction in the product development process.⁴⁷

EUROPE COULD INCREASE GDP BY €375 BILLION TO €415 BILLION A YEAR THROUGH THE IMPACT OF THE DIGITAL SINGLE MARKET ON CROSS-BORDER DIGITAL FLOWS

There are additional economic gains beyond those resulting from efficiency improvements. For instance, digital platforms have brought down the cost of international interactions and transactions, allowing small businesses to compete globally. MGI has found that even the smallest companies can be born global: 86 percent of tech startups surveyed reported some cross-border activity. Individuals are participating in globalisation directly, using digital platforms to learn, find work, showcase their talent, and build personal networks. Some 900 million people have international connections on social media, and 360 million take part in cross-border e-commerce. Global use of cross-border bandwidth grew 45-fold from 2005 to 2014, and MGI expects use to grow nine-fold between 2014 and 2021 as digital flows of commerce, information, searches, video, communication, and intracompany traffic continue to surge (Exhibit 20).⁴⁸ Over the past decade, global flows of goods, services, people, finance, and data and communications have boosted global GDP by at least 10 percent—\$7.8 trillion in 2014 alone. Data flows accounted for \$2.8 trillion of this, a larger share than global trade in goods.⁴⁹

⁴⁵ *How big data can improve manufacturing*, McKinsey & Company, July 2014.

⁴⁶ *Digital America: A tale of the haves and have-mores*, McKinsey Global Institute, December 2015.

⁴⁷ See “Automotive: Reimagining new product development”, QuantumBlack (www.quantumblack.com).

⁴⁸ *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016.

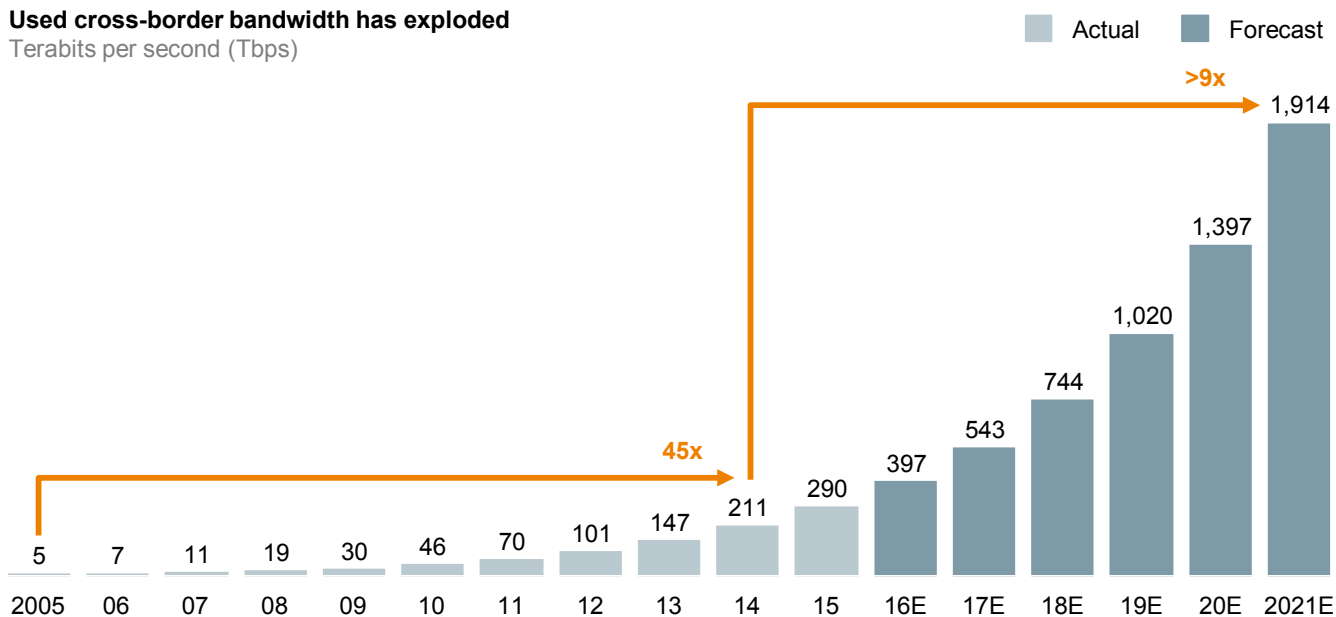
⁴⁹ *Ibid.*

Exhibit 20

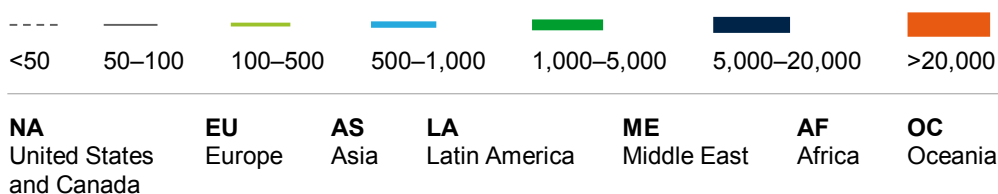
As globalisation accelerates, surging digital flows will redraw the world's borders

Used cross-border bandwidth has exploded

Terabits per second (Tbps)

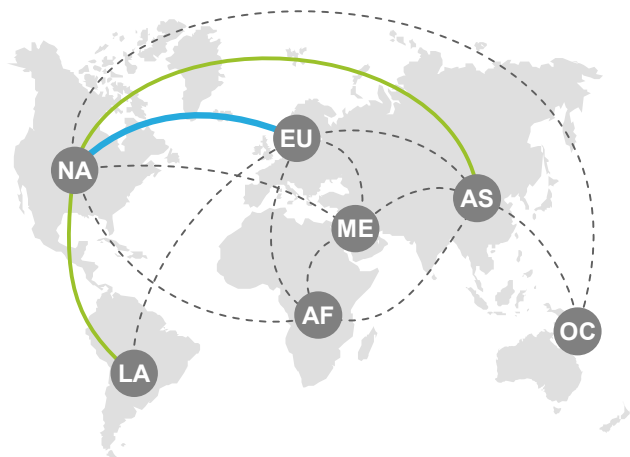


Used cross-border bandwidth



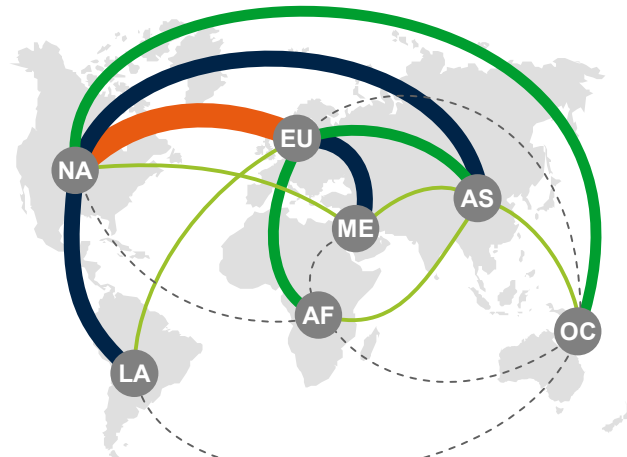
2005

100% = 4.7 Tbps



2014

100% = 211.3 Tbps



SOURCE: *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016; McKinsey Global Institute analysis

Cross-border digital flows are of particular relevance to Europe, which, together with the United States, is at the centre of the world's digital networks. Europe has the largest share of intraregional data flows among all regions. Given the size and wealth of the European market, the Digital Single Market initiative is likely to have a significant impact on Europe's GDP. But it is an acknowledged fact that there are still many barriers to the free flow of cross-border data within the European economy. For instance, the most recent Digital Agenda scorecard of the European Commission reports that only 15 percent of all EU consumers buy online from another EU country, whereas nearly 50 percent do so domestically.⁵⁰ To improve digital cross-border flows, capitalise on Europe's inherent strengths in intraregional trade, and provide European firms with the opportunity to build scale rivalling that of the United States, the European Commission has made realising the full potential of the Digital Single Market an explicit priority SM by May 2020, announcing a set of 16 measures.⁵¹ The scale advantages offered by the Digital Single Market matter to domestic firms as digitisation opens up the playing field to more global competition.⁵² Other aspects of regulation also become critical, such as rules around the interoperability of technologies and harmonisation of data flows.

The European Commission estimates that a completed Digital Single Market could add up to €415 billion a year to European GDP, based on its impact on four aspects: more broadband, more cross-border commerce, better spectrum allocation, and more skills.⁵³ In our research, we use an alternative “global flows” model based the link between a country's GDP and its level of cross-border connectedness with the rest of the world. The idea behind this model is that cross-border exchanges facilitate better reallocation of resources that translates into higher and more productive economic activity. Connectedness refers to the intensity of cross-border exchanges (both outflows and inflows) of five types of flows: goods, services, finance, people, and data. The digital component of flows is not limited to data flows; it also includes the share of goods and services flows that are driven by e-commerce. We find, for instance, that a complete Digital Single Market could double the ratio of cross-border to national digital trade of goods and services. In addition, the Digital Single Market can benefit digital cross-border flows beyond e-commerce, including web and video applications that have the potential to be produced domestically given the scale advantages offered by the single market in digital. We estimate that the combined impact of these benefits amounts to €375 billion a year. Our analysis suggests that to attain up to €415 billion a year estimated by the European Commission would require the positive GDP impact of the Digital Single Market to materialise over the next three years. If instead the potential were to take five years to unfold, only 90 percent of the impact will be captured by 2022.⁵⁴

⁵⁰ *Why we need a Digital Single Market*, European Commission Fact Sheet, May 2015.

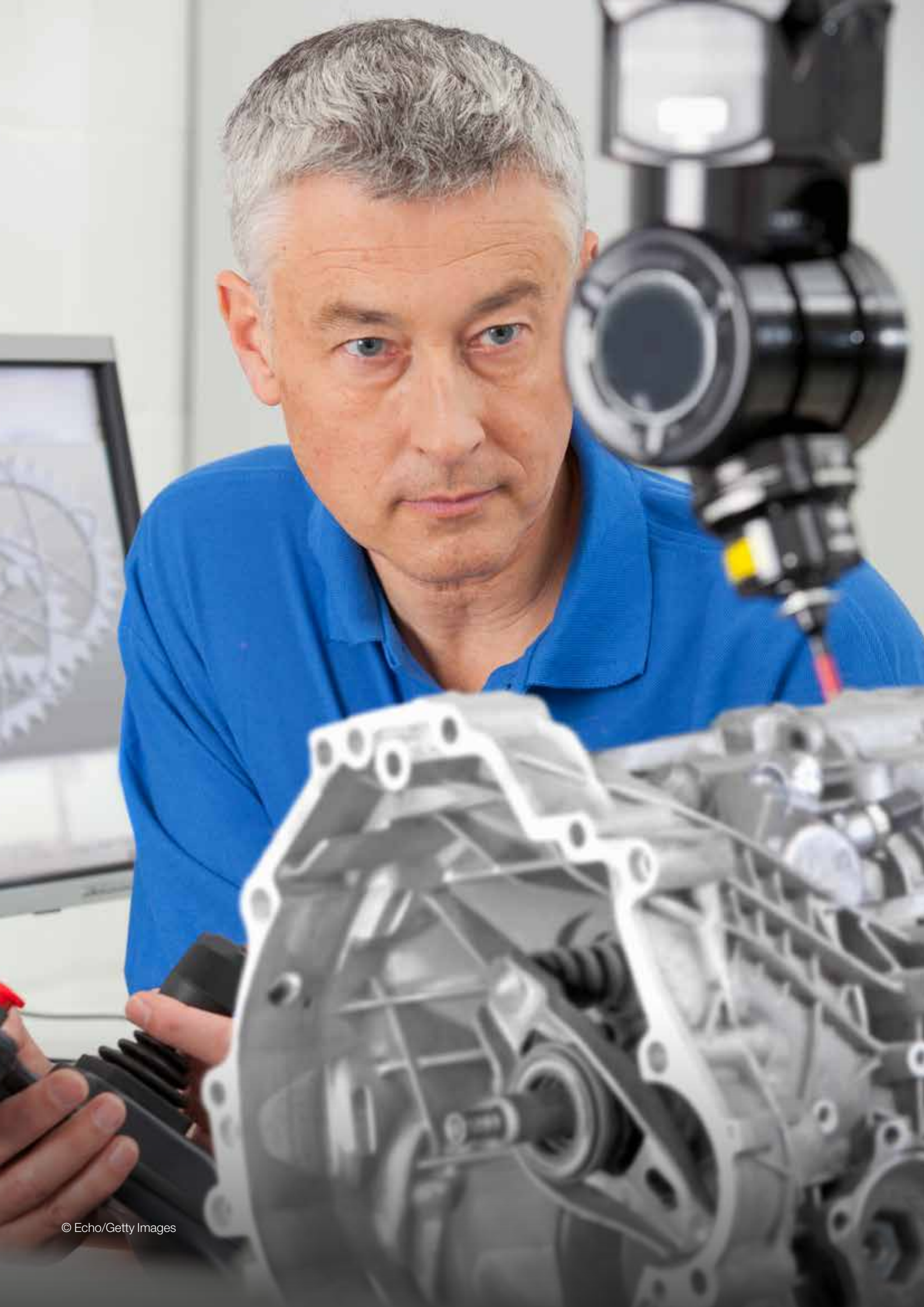
⁵¹ European Commission press release, “Commission sets out path to digitise European industry”, April 19, 2016.

⁵² *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016.

⁵³ Dimitri Lorenzani and Janos Varga, *The economic impact of digital structural reforms*, European Commission European Economy economic paper number 529, September 2014.

⁵⁴ Our estimate uses a principal component model that links cross-border flows to GDP impact, re-estimated for the EU-28, and considering the past 20 years. For details of the statistical model, refer to *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016.





4. BUSINESSES, POLICY MAKERS, AND INDIVIDUALS CAN ALL HELP TO ACCELERATE DIGITISATION

Business leaders, national and European policy makers, and individuals all have a role to play in accelerating Europe's digital transition. Companies must assess how digital matters to them, adapt their organisation, and involve suppliers and customers. Beyond creating a single market, governments should explore ways to foster new firms, boost R&D investment, and mitigate the impact of digitisation on job displacement. Individuals need to develop their skills and embrace the flexibility and new opportunities that digitisation offers them.

COMPANIES CAN CRACK THE DIGITAL CODE AND CLOSE THE GAP WITH THE DIGITAL LEADERS

Capturing the economic benefits offered by further digitisation will require profound changes in the way that companies operate and view the marketplace. Most executives were trained to understand business models based on physical assets, which require substantial time, cost, and labour to build and scale up. But now we are entering a world in which value is increasingly created from intangible assets and digital networks can achieve exponential growth. In response to this new era, companies should adapt existing business models and continue to digitise their internal operations. They should consider their approaches in six key areas: business models, agility, innovation, customer experience, capabilities, and talent management (Exhibit 21).

Exhibit 21

Companies can close the gap with digital leaders

Adapt existing business models		▪ Prioritise a handful of initiatives to exploit the biggest opportunities and consider whether it is time to move out of markets where value is declining
Digitise internal operations	Emphasise agility and learning	▪ Be continuously vigilant to spot the new technologies, startups, and disruptions brewing on the horizon ▪ Encourage a fast, agile culture
	Take advantage of new innovation models	▪ Leverage new collaborative models such as data-sharing initiatives, crowdsourcing, and virtual collaboration ▪ Use the latest digital tools to improve efficiency
	Bring the customer along	▪ Build an effective online presence ▪ Personalise offers and services
	Build—or buy—the digital capabilities needed	▪ Acquire the capabilities—processes, systems, infrastructure—and customer base to accelerate the transition ▪ Build cybersecurity defense to keep customer trust ▪ Digitise end-to-end processes to reduce costs and optimise resources
	Adapt the workforce	▪ Develop a digital culture within the organisation—even executive teams and boards need a solid understanding of technology ▪ Develop a digital talent management policy, including iterative training and recruitment when necessary ▪ Put digital tools in the hands of employees to ramp up productivity

SOURCE: McKinsey Global Institute analysis

Adapt existing business models

Focusing on potential competitive threats is important, but it is only part of the response to digitisation. Companies also need to assess *why* and *how* a market might be disrupted, and then work out whether they can take advantage or, conversely, whether they should withdraw. Thinking about digital disruption in the context of a supply-and-demand framework may help.⁵⁵ On the supply side, digital technologies can reveal sources of supply that were previously unknown or uneconomic to provide. On the demand side, digital gives consumers more complete information and unbundles or rebundles products and services in new ways (as streaming services have done with music). The dynamics on both sides create an opportunity for companies to play the role of market maker, particularly if they can find a way to lower transaction costs. TransferWise, a London-based financial technology firm, is an example; its peer-to-peer platform allows users to conduct currency exchanges at lower fees than banks charge.

The most successful digital platforms are particularly adept at this market-making function. Their enormous scale, with hundreds of millions of users, combined with their reliance on algorithms and process automation, gives them the ability to cross-sell and add new business lines with almost negligible marginal costs. As a result, companies no longer have to feel constrained by traditional sector boundaries. Amazon long ago moved far beyond its roots as a bookseller, expanding into virtually every retail category, and leveraged its massive infrastructure to become the leader in cloud-based business services. Mercedes-Benz and BMW are among the carmakers experimenting with digitally powered car-sharing services. Barclays has launched a mobile payments platform. Chinese e-commerce giants Alibaba, Tencent, and JD.com have completely disrupted the finance industry by leveraging their knowledge of their customers for credit scoring to create financial services spin-offs, including small business lending, consumer finance, and money market funds.

Digitise internal operations

Agility is vital in the digital era because of accelerated product cycles. Many companies will instinctively throw their resources into protecting their current market niche. A McKinsey study of more than 1,600 companies found that capital expenditure allocations across business units were 90 percent correlated with the previous year's allocation. But firms that reallocated capital more flexibly had a substantially higher growth rate and return to shareholders.⁵⁶ Firms with vision, optimism, and agility can realise enormous opportunities—if they are willing to disrupt their own operations before some new challenger does it for them.⁵⁷

The ability to innovate is, of course, vital. Data-sharing initiatives, crowdsourcing, and virtual collaboration can all make R&D more productive. Engineers and developers can now collaborate more or less seamlessly with suppliers to fine-tune existing products and solve design problems. Procter & Gamble and GE have both embraced open innovation, starting programmes that crowdsource ideas from outside the company. Following its founding of the International Internet Consortium along with AT&T, Cisco, IBM, and Intel, GE launched its Open Source program for Predix application developers to support the growing industrial Internet of Things.⁵⁸ AstraZeneca's Open Innovation platform, for example, invites academics, non-profits, and other partners to participate in drug discovery.⁵⁹ More

⁵⁵ Angus Dawson, Martin Hirt, and Jay Scanlan, "The economic essentials of digital strategy", *McKinsey Quarterly*, March 2016.

⁵⁶ Stephen Hall, Dan Lovullo, and Reinier Musters, "How to put your money where your strategy is", *McKinsey Quarterly*, March 2012.

⁵⁷ *Playing to win: The new global competition for corporate profits*, McKinsey Global Institute, September 2015.

⁵⁸ Predix is General Electric's software platform for the collection of data from industrial machines.

⁵⁹ At the VIVA Technology digital conference in June 2016, non-digital-native firms are exploring the challenges of digitisation on their businesses and embracing the opportunity for open innovation by asking startups to respond to these challenges. For a summary of the challenges, please see the online appendix that accompanies this report at www.mckinsey.com/mgi.

generally, large firms can stay better attuned to where the next wave of innovation is headed by holding competitions and “hackathons” or by starting their own venture capital funds, as Siemens has done. Real-time communication and file-sharing tools make it possible to access expertise virtually immediately across large organisations. But to take advantage, executives may need to discard top-down management styles and focus instead on empowering employees, suppliers, and customers as co-creators.⁶⁰

One of the most important but consistently undervalued assets for engaging with customers is an effective online presence. A passive corporate website is no longer enough; companies also need a responsive social media voice and perhaps even their own proprietary platform. Burberry, for example, has set the bar among retailers by seamlessly integrating social media and immersive experiences into its physical stores. The company recently launched a dedicated Snapchat channel, for instance, with special content that can be unlocked by scanning Snapcodes in retail stores.⁶¹ Design and storytelling can be critical to grabbing consumers’ attention in a digital world filled with endless options and distractions.

Developing the right capabilities to help accelerate digitisation is an important part of the mix. Those capabilities include systems infrastructure, processes, and even improving the customer base, together with defence of digital systems against cyberattack to ensure that those customers have high levels of trust in the company. End-to-end process digitisation helps reduce costs and optimise resources. A two-speed IT architecture, for example, helps companies develop their customer-facing capabilities at high speed while decoupling legacy systems for which release cycles of new functionality stay at a slower pace. Companies that use an increasing volume of data to inform decisions are able to detect needs and trends digitally and react to them in real time. And companies that leverage the Internet of Things can benefit from predictive analytics solutions across business verticals.

What really sets the leading sectors and companies apart from the average is the degree to which they put digital tools in the hands of their employees to ramp up productivity. The clearest value so far has been in the use of online talent platforms and social media tools for recruiting and hiring. In addition, companies should look at screening tools that use sophisticated algorithms to reduce human biases in the hiring process.⁶² Digital tools can be used to maximise employees’ performance in many ways. Appical (a Dutch startup that uses digital games) and LearnUp (which offers digital training programmes for job candidates) are just two of the companies that create tools to make the induction of new employees more productive.

EU AND NATIONAL POLICY MAKERS CAN TAKE STEPS TO CREATE A MORE DYNAMIC DIGITAL ECOSYSTEM

Companies are not the only players that must be agile in the face of rapid-fire change. Governments need an adaptive, test-and-learn regulatory approach if they are to keep up. They should consider action on two broad fronts. First, they need to continue digitising government operations in order to raise productivity. Integrating more sophisticated digital tools into their operations could allow them to deliver public services in more transparent, cost-effective, and creative ways. The second priority is to create a more dynamic digital ecosystem (Exhibit 22).

⁶⁰ Barry Libert, Jerry Wind, and Megan Beck Fenley, *Is your leadership style right for the digital age?* Knowledge@Wharton, February 6, 2015.

⁶¹ Sarah Wu, “Burberry partners with Snapchat on Mr. Burberry launch”, Forbes.com, April 4, 2016.

⁶² *A labor market that works: Connecting talent and opportunity in the digital age*, McKinsey Global Institute, June 2015.

Exhibit 22

Public authorities should facilitate the transition to digitisation

Continue to digitise government operations		- Establish government-wide coordination of IT investment and create an implementation agenda that prioritises user-centred design - Use e-government as an opportunity to reinvent government services with an eye towards transparency, accountability, participation, and responsiveness
Create a more dynamic digital ecosystem	Help European companies scale up by creating a more seamless digital market	Promote the standardisation of telecom networks, regulation standards, and the logistics of e-commerce to create a digital market comparable to that of the United States
	Deepen Europe's participation in global data flows	- Promote free flow of data initiatives - Allow users to access digital services regardless of their location within the EU
	Unlock investment in R&D and ensure entrepreneurs have access to capital	- Increase the flow of venture capital funding - Strengthen interactions among entrepreneurs, investors, and universities - Promote digital investment initiatives
	Address issues surrounding skills and the labour market	- Make digital skills a core part of education curricula - Develop targeted programmes to fill critical talent shortages such as data scientists - Develop targeted retraining programmes for workers affected by the transition to digital

SOURCE: McKinsey Global Institute analysis

40%
of EU citizens
access
government
services online

Continue to digitise government operations

In an era of debt and deleveraging, governments across Europe have been forced to become leaner—and this necessity has added momentum to the push for digitising government operations. The concept of e-government is more than simply digitising paper-based systems and establishing websites. It presents an opportunity to reinvent government services with an eye towards transparency, accountability, participation, and responsiveness. Streamlining cumbersome back-office functions can free public employees to provide better customer service to citizens, thus reducing wait times and lowering costs.

Europe is already a world leader in e-government services. France is fourth in the latest UN global rankings for e-government, followed by the Netherlands in fifth, the United Kingdom in eighth, and Finland in tenth (see Box 4, “European government digital success stories”).⁶³ But continent-wide, only 40 percent of EU citizens access government services online.⁶⁴ Capabilities vary dramatically, not just at the regional and national levels, but particularly at the municipal level. The Internet of Things has exciting potential to improve the way cities manage traffic, transit, water, energy use, emergency response, and other complex systems. The largest cities are beginning to move in this direction but have only scratched the surface of what is possible.

⁶³ *United Nations e-government survey 2014: E-government for the future we want*, United Nations, 2014.

⁶⁴ “Europe’s e-government opportunity”, McKinsey.com, March 2015.

Box 4. European government digital success stories

One of the most remarkable success stories is Estonia, which is one of the leading countries for e-government services. For example, citizens review pre-filled tax forms online and receive their tax refunds in two days. The country's online services rely on seamless data sharing among agencies and consistent digital identification and signature protocols.¹

Across Europe, there are examples of governments improving the delivery of services using digital tools. Norway is digitising sick leave benefit processes end-to-end to improve service and cut costs. Denmark is digitising its prisoner release system, making it easier to coordinate with social services to help people reengage in the community more smoothly and prevent relapses into crime. In the past, a released prisoner would wait months for help with housing. Today, the digital process automatically alerts social services two weeks prior to a prisoner's release, triggering a request for a housing search. In Germany, Jobbörse is an app that digitally supports citizens through the whole process of looking for a job. In March 2012, the site had 18 million unique visitors per day, compared with eight million for the leading private-sector competitor.

Governments are beginning to capture significant cost savings. Previous MGI research examined the potential for big-data analytics alone to transform US government services by 2020. In addition to productivity gains of up to \$95 billion annually, it found \$280 billion to \$460 billion in potential savings. Some of the most promising areas for savings include minimising payments made in error, improving procurement, and making tax collection more effective.²

Fully digitising government services and integrating next-generation technologies into government departments is easier said than done. Lack of compatibility among information technology (IT) systems and fragmented data ownership that spans various departments pose major challenges. Additionally, IT skills are in high demand, and public-sector entities need to create career opportunities that can lure the necessary talent away from higher-paying jobs in the private sector. Joint research by McKinsey and Oxford University found that public-sector IT projects were six times as likely to experience cost overruns and 20 percent more likely to run over schedule as comparable projects in the private sector.³

Establishing government-wide coordination of IT investment can help to overcome some of these challenges. Denmark, for example, set up a digital council to serve as a central IT steering group. In addition to creating specific methodologies and guidelines for IT investment, it shares best practices and manages the project pipeline to ensure that the government is capturing all possible synergies. The Netherlands established an implementation agenda that prioritised user-centred design; it also created a government-wide project dashboard and convened public-sector IT managers to disseminate key lessons.⁴ Taking a page from global trailblazers such as South Korea, governments will need to invest in mobile and multichannel platforms. Agencies can also reach citizens in a cost-effective way by engaging with them on established social media platforms rather than building their own.

¹ Sten Tamkivi, "Lessons from the world's most tech-savvy government", *The Atlantic*, January 24, 2014.

² *Game changers: Five opportunities for US growth and renewal*, McKinsey Global Institute, July 2013.

³ Michael Bloch, Sven Blumberg, and Jürgen Laartz, "Delivering large-scale IT projects on time, on budget, and on value", *McKinsey Quarterly*, October 2012.

⁴ "Public-sector digitization: The trillion-dollar challenge", McKinsey.com, December 2014.

19

EU countries in the list of 25 most connected countries, according to MGI Connectedness Index

Create a more dynamic digital ecosystem

Creating a seamless digital market in Europe is an important lever for growth. According to an analysis by the European Parliamentary Research Service, a fully integrated digital sector could boost Europe's annual GDP growth by 0.45 percent in a decade.⁶⁵ A 2014 European Commission paper suggests that reinforcing the integration of the Digital Single Market and e-business models could boost growth by 1.9 percent.⁶⁶ The European Commission made creating a single digital market a priority in 2012, and action has picked up. Since 2011, 14 directives have been adopted on key areas such as harmonising consumer rights, electronic identification, value-added taxes, and digital content rights, and they have tended to be transposed (or implemented) by member states. While breaking barriers for improving digital marketability is a European priority, there is a long way to go. One of the biggest advantages afforded by digitisation is scale, but Europe's digital landscape remains fragmented in terms of telecom networks, regulations, standards, and the logistics of e-commerce. Just 15 percent of EU consumers purchase online from other EU countries, and only 7 percent of Europe's small and medium-sized businesses sell cross-border.⁶⁷ Only 4 percent of the online services used in Europe are EU-based and cross-border in scope; the vast majority are either US-based or geared to their national market.⁶⁸ Allowing and encouraging telecom providers to build out more seamless cross-border high-speed digital networks and harmonising varied regulations on privacy and cybersecurity could remove some of the barriers to creating a regional ecosystem with bigger scale. Ensuring that sector regulation evolves to ensure the development of new businesses, and fair and intense competition, is paramount.

European policy makers can also influence the region's connectedness, specifically the free flow of data through open data regulation. The new EU-US Privacy Shield framework for transatlantic data flows is a positive step towards ensuring and expanding participation, but policy makers across the continent need to develop a real sense of urgency on these issues. Although EU countries occupy 19 of the top 25 slots in MGI's global ranking of participation in cross-border data flows, with the Netherlands topping the list, a closer look shows a steep drop-off in scores for the other EU countries. One positive sign is the EU's recent launch of an open portal to facilitate data sharing among public-sector entities across the continent. In addition, the European Commission has announced plans for a new European Open Science Cloud to connect researchers throughout Europe and allow them to store and share data across borders. This project will rely on a new European Data Infrastructure built on high-capacity networks, large-scale storage, and the supercomputer capacity necessary to analyse large data sets stored in the cloud.⁶⁹

Unlocking investment in R&D is another area that governments can, and should, address. This is particularly important given that the digital variance between sectors in a given country is twice as large as that between countries in a given sector. Europe suffers from a private-sector R&D investment gap with the United States. A recent report from the European Investment Bank finds that for the European Union to match US levels of venture capital financing as a share of GDP would require around €35 billion a year in additional venture capital activity.⁷⁰ Most of this would have to come from private investors, but some well-targeted public investment and partnerships can provide a push.

⁶⁵ Joseph Dunne, *Mapping the costs of non-Europe, 2014–19*, European Parliamentary Research Service, March 2014. For further discussion, also see *A window of opportunity for Europe*, McKinsey Global Institute, June 2015.

⁶⁶ Dimitri Lorenzani and Janos Varga, *The economic impact of digital structural reforms*, European Commission European Economy economic paper number 529, September 2014.

⁶⁷ Digital Single Market fact sheet, "Why we need a Digital Single Market", European Commission, May 2015.

⁶⁸ Ibid.

⁶⁹ "European Cloud Initiative to give Europe a global lead in the data-driven economy", European Commission press release, April 19, 2016. For more on potential value of data sharing, see *Open data: Unlocking innovation and performance with liquid information*, McKinsey Global Institute, October 2013.

⁷⁰ *Restoring EU competitiveness*, European Investment Bank, January 2016.

Finally, governments have a major role to play in addressing the skills needed to power the digital economy; workers will need the support of government as they retrain and adapt to changing conditions. Concentrated programs that help workers learn new skills need to be made widely available. But, on top of this, there is a major opportunity to use the huge amount of data now available on educational outcomes, skills, and career paths to design a much more effective education and training system. As more economic activity takes place through digital platforms for freelance work and on-demand services, policy makers will need to update regulatory frameworks to take these new working models into account and clarify how project-based workers are treated under the law. Germany and Sweden, for example, have a “dependent contractor” category that grants some additional protections to workers who fall somewhere between employees and independent contractors and are dependent on a single employer.⁷¹

ALL INDIVIDUALS WILL BENEFIT FROM DIGITISATION AS CONSUMERS, BUT MANY WILL NEED TO FACE CHALLENGES AS WORKERS

The large majority of individuals in Europe benefit hugely from digitisation as consumers; as workers, the impact is more mixed, or potentially mixed. As we have discussed, although digitisation—and specifically automation—is displacing many people in the workplace, digital tools and platforms and new ways of working also offer many opportunities; individuals need to seize them. Those who may be unsettled by the impact of digital technologies on their employment prospects should look carefully at the personal and professional opportunities that digital opens up to them. Four aspects are worth consideration (Exhibit 23).

Exhibit 23

Individuals must seize the opportunities offered by the coming transition

Prepare for a brave new world of work	▪ Be ready to take several job opportunities and to attend retraining programmes ▪ Avoid online indiscretions that can affect professional reputation ▪ Build a personal online presence
Be ready to become your own boss	▪ Seize the opportunity to be your own boss since barriers to entry are falling, allowing anyone with a great idea—even with limited capital—to become an entrepreneur ▪ Leverage online platforms that help to connect customers and freelancers
Take advantage of a marketplace that puts the consumer in the driver's seat	▪ Take the maximum of the consumer surplus (e.g., price comparison websites) ▪ Use online platforms to generate additional income
Embrace tools that give citizens new ways to make their voices heard	▪ Use the Internet as a way to express yourself by funding the projects you support ▪ Use the Internet as a way to get fresher and more diverse news ▪ Connect with people from all over the world

SOURCE: McKinsey Global Institute analysis

Individuals need to develop their skills to keep pace with the evolving demands of an increasingly digitally driven labour market, and they need to be flexible. In a world where the demand for skills changes rapidly, the days of joining an employer, rising through the ranks, and staying for decades may be over. Workers will face more uncertainty and more frequent transitions—but a greater range of options and more flexibility are available to those who successfully adapt.

⁷¹ Judy Fudge, Shae McCrystal, and Kamala Sankaran, eds., *Challenging the legal boundaries of work regulation*, Hart Publishing, 2012. See also Lauren Weber, “What if there were a new type of worker? Dependent contractor”, *Wall Street Journal*, January 28, 2015.

Digital technologies offer new scope for individuals to become their own boss. Barriers to entry are falling, allowing anyone with a connection and a great idea—even if capital is limited—to become an entrepreneur. Digital technology has put powerful tools, such as enterprise software and cheap computing power on the cloud, within reach. In 2014, for example, Apple announced that nine million registered app developers were within its ecosystem.⁷² The biggest social media platforms have become effective marketing tools for small businesses of all kinds. Facebook estimates that 50 million small and medium-sized enterprises are on its platform, double the number in 2013.⁷³ More than ten million freelancers are registered on Upwork alone, offering services such as web development, graphic design, and marketing. The “on-demand” digital economy also extends well beyond professional services to the full range of personal services. There are platforms for contingent workers who will run errands, perform home repairs, clean houses, and walk dogs. Some workers join these sites as a flexible part-time option to supplement their regular income, while others turn contingent work into a full-time job.⁷⁴ While such arrangements have been around for a while, platforms make the matching of tasks and people to perform them more efficient, transparent, and scalable.



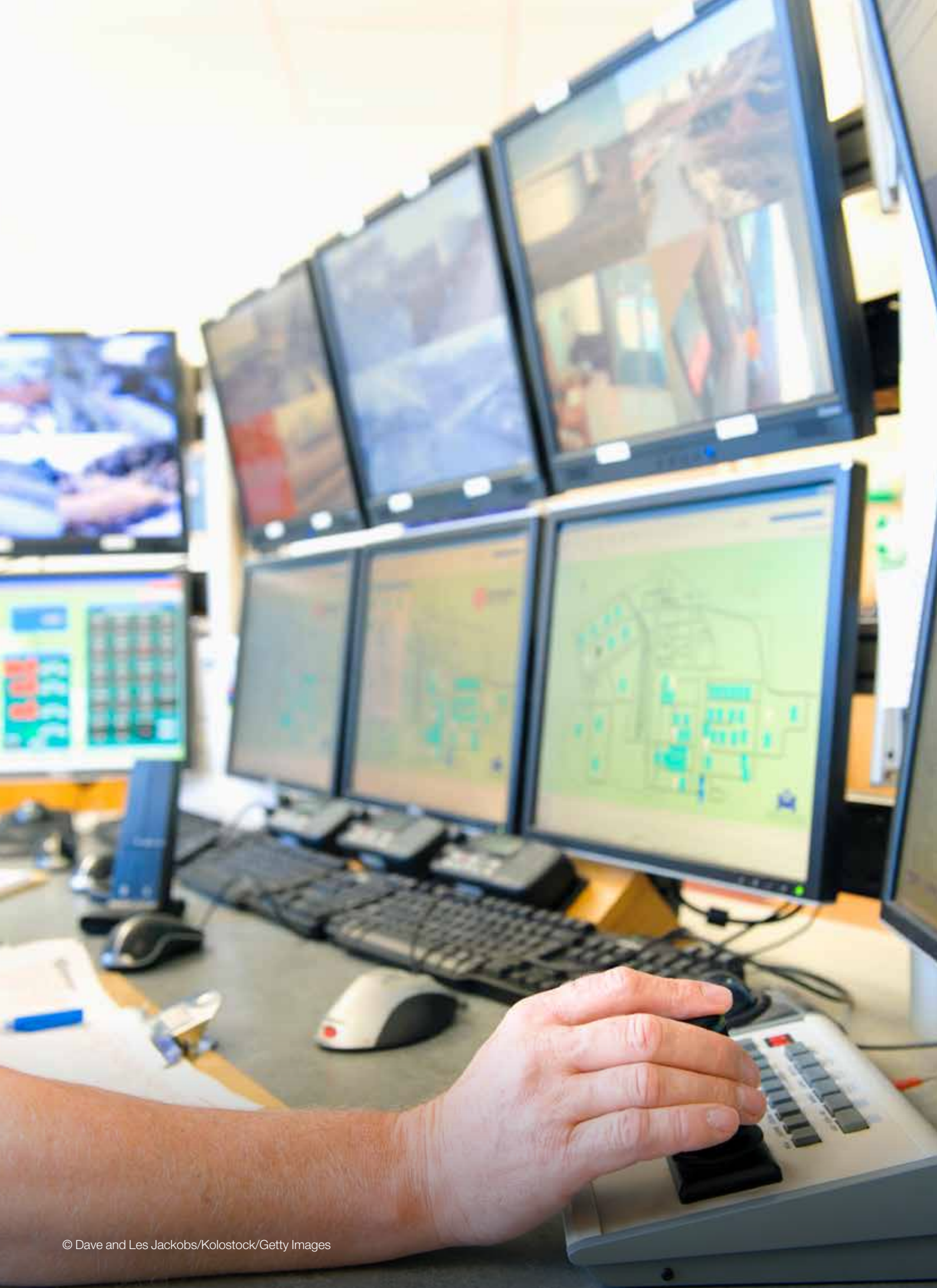
Digital technologies are already transforming Europe, and they are spreading at an accelerating speed. Some European countries are embracing this new era with aggression and reaping the economic rewards, but some are less enthusiastic. Europe has many leading and highly successful digitised companies, but the fact remains that the region is dependent on imports of US digital assets, rather than developing them at home and maximising their benefits. Overall, Europe is far from making full use of the potential of digitisation, but that can easily change with concerted action by companies, governments, and, indeed, individuals. We all need to manage the transition to secure the undoubted economic benefits that lie ahead—and change, just as the world is changing as it digitises.

⁷² Sarah Perez, “iTunes app store now has 1.2 million apps, has seen 75 billion downloads to date”, TechCrunch, June 2, 2014.

⁷³ *Digital globalization: The new era of global flows*, McKinsey Global Institute, March 2016.

⁷⁴ *A labor market that works: Connecting talent and opportunity in the digital age*, McKinsey Global Institute, June 2015.





BIBLIOGRAPHY

A

Acemoglu, Daron, and David Autor, “Skills, tasks and technologies: Implications for employment and earnings”, in *Handbook of Labor Economics*, volume 4, part B, Orley Ashenfelter and David Card, eds., Elsevier, 2011.

Agarwal, Rajat, Shankar Chandrasekaran, Mukund Sridhar, and Paul-Louis Caylar, *The digital future of construction*, McKinsey & Company case study, June 2016.

Alaveras, Georgios, and Bertin Martens, *International trade in online services*, Institute for Prospective Technological Studies Digital Economy working paper number 08, Joint Research Centre technical reports, European Commission, 2015.

B

Baily, Martin N., and James Manyika, *Reassessing the Internet of Things*, Project Syndicate, August 2015.

Bloch, Michael, Sven Blumberg, and Jürgen Laartz, “Delivering large-scale IT projects on time, on budget, and on value”, *McKinsey Quarterly*, October 2012.

Booth, Adrian, Niko Mohr, Peter Peters, and Sebastien Leger, *The digital utility: New opportunities and challenges*, McKinsey & Company case study, June 2016.

Bravo-Biosca, Albert, *A look at business growth and contraction in Europe*, Nesta working paper number 11/02, December 2011.

Brynjolfsson, Erik, and Lorin M. Hitt, “Computing productivity: Firm-level evidence”, *Review of Economics and Statistics*, volume 84, number 4, November 2003.

Bughin, Jacques, “The Internet’s €100 billion surplus”, *McKinsey Quarterly*, January 2011.

Bughin, Jacques, and James Manyika, “Measuring the full impact of digital capital”, *McKinsey Quarterly*, July 2013.

Bughin, Jacques, and James Manyika, “The mobile Internet’s consumer dividend”, *McKinsey Quarterly*, February 2014.

C

Catlin, Tanguy, Somesh Khanna, Johannes-Tobias Lorenz, and Sandra Sancier-Sultan, *Making digital strategy a reality in insurance*, McKinsey & Company case study, June 2016.

Catlin, Tanguy, Jay Scanlan, and Paul Willmott, “Raising your Digital Quotient”, *McKinsey Quarterly*, June 2015.

Caylar, Paul-Louis, Olivier Noterdaeme, and Kedar Naik, *Digital in Industry: From buzzword to value creation*, McKinsey & Company case study, June 2016.

Caylar, Paul-Louis, and Alexandre Menard, *How telecom companies can win in the digital revolution*, McKinsey & Company case study, June 2016.

Chui, Michael, James Manyika, and Mehdi Miremadi, “Four fundamentals of workplace automation”, *McKinsey Quarterly*, November 2015.

Corrado, Carol, and Kirsten Jäger, *Communication networks, ICT and productivity growth in Europe*, The Conference Board Report for Telefónica SA, 2014.

Cowen, Tyler, *The great stagnation: How America ate all the low-hanging fruit of modern history, got sick, and will (eventually) feel better*, Dutton, 2011.

D

Dawson, Angus, Martin Hirt, and Jay Scanlan, “The economic essentials of digital strategy”, *McKinsey Quarterly*, March 2016.

Denchev, Vasil S., Sergio Boixo, Sergei V. Isakov, Nan Ding, Ryan Babbush, Vadim Smelyanskiy et al., *What is the computational value of finite range tunneling?* Google, December 11, 2015.

Diaz-Williams, Zana, *Industrial technology trends: Industry 4.0 related patents have grown by 12x in 5 years*, IOT Analytics newsletter, March 1, 2016.

Digital Insurance in Action, *AXA's digital initiatives*, The Digital Insurer, accessed June 1, 2016.

Dilmegani, Cem, Bengi Korkmaz, and Martin Lundqvist, *Public-sector digitization: The trillion-dollar challenge*, McKinsey.com, December 2014.

Dunne, Joseph, *Mapping the costs of non-Europe, 2014–19*, European Parliamentary Research Service, March 2014.

E

European Commission, “European Cloud Initiative to give Europe a global lead in the data-driven economy”, press release, April 19, 2016.

European Commission, “Why we need a Digital Single Market”, Digital Single Market fact sheet, May 2015.

European Investment Bank, *Restoring EU competitiveness*, January 2016.

F

Friedrich, Roman, Florian Gröne, Alex Koster, and Matthew Le Merle, *Measuring industry digitization: Leaders and laggards in the digital economy*, Strategy&, originally published by Booz & Company, December 13, 2011.

Fudge, Judy, Shae McCrystal, and Kamala Sankaran, eds., *Challenging the legal boundaries of work regulation*, Hart Publishing, 2012.

G

Gantz, John, and David Reinsel, *The digital universe in 2020: Big data, bigger digital shadows, and biggest growth in the Far East*, IDC country brief, December 2012.

Gordon, Robert J., *Is US economic growth over? Faltering innovation confronts the six headwinds*, NBER working paper number 18315, August 2012.

Gordon, Robert J., “US productivity growth: The slowdown has returned after a temporary revival”, *International Productivity Monitor*, number 25, spring 2013.

H

Hall, Stephen, Dan Lovallo, and Reinier Musters, “How to put your money where your strategy is”, *McKinsey Quarterly*, March 2012.

Harrigan, James, Ariell Reshef, and Farid Toubal, *The march of the techies: Technology, trade, and job polarization in France, 1994–2007*, NBER working paper number 22110, March 2016.

I

IAB Europe, *Consumers driving the digital uptake: The economic value of online advertising-based services for consumers*, September 2010.

K

Katz, Lawrence F., and Alan B. Krueger, *The rise and nature of alternative work arrangements in the United States, 1995–2015*, March 29, 2016.

Kirchherr, Julian, Julia Klier, and Sebastian Stern, “Europe’s e-government opportunity”, McKinsey.com, March 2015.

L

Lacroix, Sebastien, Pedro Rodeia, and Zubin Taraporevala, *The battle for digital banking*, McKinsey & Company case study, June 2016.

Laizet, Franck, *The war for immediacy: Digital in retail*, McKinsey & Company case study, June 2016.

Lauchlan, Stuart, *Burberry—moving from digital prowess to e-commerce leadership*, Diginomica, May 20, 2016.

Libert, Barry, Jerry Wind, and Megan Beck Fenley, *Is your leadership style right for the digital age?* Knowledge@Wharton, February 6, 2015.

London, Thomas, and Penelope Dash, *Health systems: Achieving sustainability and improving quality through digital transformation*, McKinsey & Company case study, June 2016.

Lorenzani, Dimitri, and Janos Varga, *The economic impact of digital structural reforms*, European Commission European Economy economic paper number 529, September 2014.

M

Magnin, Clarisse, *How big data will revolutionize the global food chain*, McKinsey & Company case study, June 2016.

Malone, Thomas W., Robert Laubacher, and Tammy Johns, “The big idea: The age of hyperspecialization”, *Harvard Business Review*, July-August 2011.

McAfee, Andrew, and Erik Brynjolfsson, “Investing in the IT that makes a competitive difference”, *Harvard Business Review*, July-August 2008.

McKinsey & Company, *Accélérer la mutation numérique des entreprises: un gisement de croissance et de compétitivité pour la France (Accelerating companies’ digital transformation: A reservoir of growth and competitiveness for France)*, September 2014.

McKinsey & Company, *Europe’s e-government opportunity*, March 2015.

McKinsey & Company, *How big data can improve manufacturing*, July 2014.

McKinsey & Company, *Industry 4.0: How to navigate digitization of the manufacturing sector*, 2015.

McKinsey Global Institute, *Digital America: A tale of the haves and have-mores*, December 2015.

McKinsey Global Institute, *Digital globalization: The new era of global flows*, March 2016.

McKinsey Global Institute, *An economy that works: Job creation and America’s future*, June 2011.

McKinsey Global Institute, *Game changers: Five opportunities for US growth and renewal*, July 2013.

McKinsey Global Institute, *Global flows in a digital age: How trade, finance, people, and data connect the world economy*, April 2014.

McKinsey Global Institute, *The Internet of Things: Mapping the value beyond the hype*, June 2015.

McKinsey Global Institute, *A labor market that works: Connecting talent and opportunity in the digital age*, June 2015.

McKinsey Global Institute, *Open data: Unlocking innovation and performance with liquid information*, October 2013.

McKinsey Global Institute, *Playing to win: The new global competition for corporate profits*, September 2015.

McKinsey Global Institute, *Secular stagnation and low investment: Breaking the vicious cycle*, discussion paper, April 2016.

McKinsey Global Institute, *A window of opportunity for Europe*, June 2015.

Moore, Jan-Peter, and Stefano Martinotti, *Enabling seamless lifelong learning journeys: The next frontier of digital education*, McKinsey & Company case study, June 2016.

O

OECD, *Automation and independent work in a digital economy*, policy brief, May 2016.

OECD, *The future of productivity*, 2015.

S

Spence, Michael, *Automation, productivity, and growth*, Project Syndicate, August 2015.

T

Tadjeddine, Karim, and Martin Lundqvist, *Policy in the data age: Data enablement for the common good*, McKinsey & Company case study, June 2016.

U

UK Cabinet Office, *£10bn saved in 2012/13: Efficiency and reform 2012/13 summary report*, 2013.

United Nations, *United Nations e-government survey 2014: E-government for the future we want*, 2014.

US Commerce Department, *Digital economy and cross-border trade: The value of digitally-deliverable services*, Economics & Statistics Administration, January 27, 2014.

V

Van Ark, Bart, *Productivity and digitalisation in Europe: Paving the road to faster growth*, The Lisbon Council and The Conference Board policy brief, 2014.

W

World Economic Forum, *The future of jobs: Employment, skills and workforce strategy for the fourth Industrial Revolution*, January 2016.

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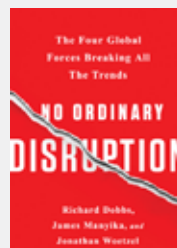
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